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RECORDING VOTES BY ELECTRIC MEANS.

The time consumed by roll calls in the sessions of our national Congress and state legislatures, as well as smaller parliamentary bodies, is notorious, and the necessity for such roll calls frequently interferes to a marked extent with the progress of legislative business. This interference is sometimes considered by a minority as a desirable proceeding and it is, of course, well known that many roll calls are requested for the mere purpose of gaining time and delaying the passage of legislation. Since, however, majorities are supposed to govern in legislative bodies and such tactics are only resorted to to defeat the will of the majority, any arrangement which will make such roll calls unnecessary would seem to be in the public interest.

The matter is brought to attention at this time since a scheme has been presented to the Rules Committee of the House of Representatives at Washington by Representative Walsh which will enable votes to be recorded instantaneously and simultaneously, so that a roll call of the House need only occupy a few seconds. The scheme proposed by Mr. Walsh is an electrical one and by its means the pressing of a button by each member at his desk would cause his vote to be indicated upon a bulletin board by means of colored lamps and thus be visible to all.

Mr. Walsh is said in the press dispatches to be an electrician who has worked out the details of such a scheme himself. While these details are unknown to us at this writing, it will be apparent to anyone familiar with electrical indicating devices that such an arrangement is entirely feasible and simple in design. Indeed this is not the first time that such a system has been proposed and the wonder is only that it has never been adopted in parliamentary procedure. The saving of time and the doing away with filibustering whose only object is to defeat the will of the majority would be important gains, while at the same time the method would prove much more convenient to both the clerk and to the members who answer his call by voice. Such a system could easily be made safe from interference, so that a member's vote could not be registered by another in his absence, and the only objections that can be raised to such a device would be on the part of those who wish to continue the present opportunities for delay. With one of their own number to explain the advantages of such an installation, congressmen should be easily convinced of its desirability.

THE PROPER CONDUIT FOR A CIRCUIT.

One of the important advantages of the metal-protected interior electric circuit, when it has been properly installed, is the ease with which conductors may be removed and replaced with others in case grounds or short-circuits develop after a circuit has been put in. The wires are made accessible in metal molding by the removal of the capping; defective sections of concealed armored cables can be pulled out and new sections substituted; unless there is overcrowding, wires can be withdrawn from a run of conduit and other wires pulled in.

In the case of rigid-conduit work for circuits designed for heavy currents, however, the construction is altogether too frequently such that the foregoing advantage is missed. This seems to be particularly true of direct-current wiring where a separate conduit is provided for each large conductor. In the absence from the National Electrical Code—and often from the local inspection rules, as well—of tables specifying the size of conduit that must be used for a given size and number of conductors, there is a too general disposition among wiremen to crowd too much copper into a pipe. When a horizontal cable whose outside diameter is little or no less than the inside diameter of the conduit is pulled in with a winch which it takes four men to operate, while two men are needed at the opposite end of the pipe to push the conductor in and keep its surface covered with a lubricant, the possibility of subsequent removal of the conductor from the conduit becomes exceedingly remote. A breakdown in the insulation, which, by the way, such methods of installation are quite liable to induce, is almost certain to necessitate the putting in of a new section of conduit.

In laying out work of the kind referred to there ought to be more frequent use than there is of data like those prepared by the National Electrical Contractors' Association not long ago. It would seem, moreover, that data of this kind, in tabular form, would be in place in the National Code and in the electrical codes of all municipalities.

WATER-POWER DEVELOPMENT ON THE PUBLIC DOMAIN.

For several years the Federal Government has lacked a definite policy regarding the development of water power along those streams, mainly in the Far West, which are bordered by government lands, and upon which hydroelectric projects consequently could not be carried out without federal authority. The old method of giving grants for this purpose with few or no restrictions upon the use of the stream was very properly abandoned, but the difficulty has been that no more appropriate policy was formulated and consequently the development of such projects has languished.

The attitude of the present administration appears to be one of action and now, at last, the Secretary of the Interior has announced a definite policy for dealing with this question and has enunciated the general principles according to which permits of this kind will be granted in the future. The conditions are such as to encourage the greatest use of the water for power purposes, while at the same time safeguarding the public, as represented by the users of power, from excessive charges or other onerous conditions of use at any future time. While a tax or charge will be imposed, payable to the Federal Government, the idea of this is not so much to constitute a source of revenue as to recognize the title and authority of the government and to make a consideration for the grant.

The question comes up at this time upon the application of the International Power & Manufacturing Company for authority to institute a development upon the Pend d'Orielle River in the Kaniksu National Forest in the northeastern part of the state of Washington. The ultimate capacity estimated for this project is 350,000 horsepower.

The announcement of a definite policy under such fair conditions should result in a resumption of the activities which were so markedly curtailed a half-dozen years ago on account of the uncertain and hostile attitude of the federal administration at that time.

THE PROPER BASIS FOR RATES.

A curious case has recently been decided by the Wisconsin Railroad Commission and is reported elsewhere in this issue. In this case a utility which is municipally owned and operated applied for permission to increase its rates to those consumers only who are residing outside of the municipality. While the Commission denied the application, it at the same time discussed the principles which should govern such cases and indicated that it was proper to make a distinction between residents and non-residents of a municipality. This distinction is based upon the fact that in computing the fixed charge against the investment only four per cent is used in connection with that portion of the plant necessary for supplying resident consumers, whereas an interest allowance of 7.5 per cent is used in computing the fixed charges for that portion of the plant necessary to supply non-residents. This is the same percentage that would be allowed in the case of a privately owned utility.

The distinction appears to be made on the basis that the taxpayers in the municipality have involved some risk in investing municipal funds in the electric power plant. To carry out this idea logically, the same distinction should be made between taxpayers and all those who are not. If such a distinction is justifiable it would seem equally proper for a privately owned utility company to make a distinction in rates between those

consumers who are stockholders and those who are not.

Upon the basis of the cost-of-service principle, rates should be adjusted so as to just cover the cost of operation, including fixed charges, and allowing as small a margin of surplus as may be feasible. The proper allowance for fixed charges is usually estimated upon the basis of what return is necessary to make the investment a desirable one, so that future necessities for capital for extensions, etc., will be willingly met by the investor. Since it is possible to secure capital for a municipal plant at a lower rate of interest than for a privately owned plant, this element of the cost of service is inherently smaller and all patrons of the utility should receive the benefit of this lower cost. Why the consumer who resides outside the political boundary of the municipality should be discriminated against in this regard, especially with respect to the consumer within the boundary who is not a taxpayer, is not evident.

ELECTRICAL APPLIANCES FOR THE HOTEL.

Some of the electrical contractors who attended the recent annual convention of the National Electrical Contractors' Association carried electric fans with them to Chattanooga. This incident and the discomfort on account of the intense heat experienced by others who had no fans leads one to suggest that, with the proper sort of effort, the electrical dealer ought to be able to place in the average hotel a much more generous supply of electrical appliances than is now usually found there. Being in business for the purpose of making money, the hotel manager is usually a ready purchaser of anything that he is sure will add to the popularity of his place and increase its patronage wihout excessive expense. In most sections of the country, there are few things that would add more to the comfort of the hotel guest in summer, or for which he would be more willing to pay liberally, than the use of an electric fan in his room. That there are not more of these in hotel rooms now is due to the fact that the electrical salesman has not taken due advantage of the opportunity to place them there.

The practice of installing wall receptacles for attachment plugs in hotel bedrooms is one that seems to be growing. A new building of the kind is recalled now in which there are receptacles for three such plugs in every bedroom. These are intended to provide connections for a table or desk lamp, for a fan, and for an electric curling iron or other dressing-room appliance. This sort of thing is sure to prove profitable for the hotel and the electrical dealer. To go a step further and provide the room permanently with some of the most used appliances would, in the case of the high-class house, prove even more profitable.

A SUGGESTION CONCERNING CONTRACTORS' CONVENTIONS.

The electrical contractor is one of the most interesting representatives of the electrical industry. As a rule he is a man whose professional education has been acquired in the routine of the day's work. The ladder and the tool kit have usually been his principal textbooks, and his philosophy, whatever criticism of it there may be, is generally the pure product of experience. Out of this sort of training has come a class of men that is more or less unique. For example, among electrical contractors the fellow afflicted with an exaggerated notion of his own importance is an exceptionally rare individual; men who have had to make their way against unusual difficulties are not liable to be thus afflicted, however successful they may have been. Thus it happens that at a large gathering of contractors, such, for instance, as the recent convention of the National Electrical Contractors' Association at Chattanooga, a thing most noticeable is the spirit of good will and free and easy association that prevails.

In matters of business, however, the contractor is often suspicious of even his friends. Difficulties he has encountered in his efforts to gain for his business the recognition it deserves, and poor practices on the part of unwise competitors with which he has had so often to contend, seem sometimes to cause him to feel that secrecy is the price of success. This is probably why so many of the sessions at conventions of contractors are open to members only.

As the foregoing remarks are intended to indicate, we believe we have a rather correct appreciation of the position of the contractor and nothing in the way of adverse criticism of him is meant here. It does seem unfortunate, though, that more of the sessions of state and national conventions cannot be kept open to the public. One of the things that the progressive electrical contractor needs most is that he be better understood by other representatives of the electrical industry and better known to the public in general. The bare assertion that he is a contractor and that he is a member of this or that organization cannot be relied upon to secure for him the place he seeks. The public needs to know him as a specialist in electrical construction, and that he is the one man who can best be depended upon to install electrical work that is safe and permanent and good. The sort of publicity that would come from open sessions at conventions for the presentation of papers on electrical work would surely do a great deal toward bringing the contractor forward in the light of a specialist. There are few conventions that could not secure papers of this sort, nor where the discussions of them could not be made lively and helpful. Such papers and discussions would add to the convention and promote the cause of the contractor.

Government Institutes Suit to Break Up Bell Telephone Merger.

The first important suit under the Sherman anti-trust law by the Wilson Administration was filed on July 24, at Portland, Ore. It was aimed at the American Telephone and Telegraph Company and its subsidiaries, and is designed to bring about the dissolution of the so-called telephone merger on the Pacific coast, through which the Bell companies, it is charged, have established a monopoly of the telephone business in the States of Oregon, Washington, Montana and Idaho.

The Federal Government seeks to bring about the divorcement from the Bell companies of nine companies which formerly operated as independents and which it is charged have been driven into an amalgamation with the Bell companies since 1905.

The Department of Justice under Mr. Wickersham conducted an investigation for many months into the question whether the American Telephone and Telegraph Company, with its capitalization of $393,000,000, and its assets of $924,000,000, is a combination in violation of the Sherman law, but finally decided to refer the matter to the Interstate Commerce Commission for further inquiry. The present suit has no bearing on this larger question. A statement issued by the Department of Justice in this connection says:

"This proceeding is brought to correct an exceptional condition and will not in any way interfere with the broad investigation of telephone conditions throughout the entire country undertaken by the Interstate Commerce Commission upon the suggestion of the former Attorney-General."

Among the individual defendants named in this suit are Theodore N. Vail, president of the American Telephone and Telegraph Company; Union H. Bethell, W. R. Driver, Edward J. Hall, N. C. Kingsbury, B. E. Sunny, H. B. Thayer, Charles P. Ware, Henry T. Scott, E. C. Bradley, F. W. Eaton, H. S. King, F. S. Drumm, Timothy Hopkins, W. H. Crocker, Jr., E. M. Burges and William Mead.

The Government asks that the alleged combination brought about by the Bell companies be dissolved through the court ordering the defendants to dispose of the stocks, bonds and physical property of the competing system, which it is alleged they have unlawfully acquired to persons not connected with the Bell companies as stockholders or otherwise. It is averred that competitve conditions will thus be restored.

The companies formerly independent that are involved in the suit are the Northwestern Long Distance Telephone Company of California, capitalized at $630,000; the Home Telephone Company of Puget Sound, capitalized at $1,317,000; the Independent Telephone Company of Seattle, capitalized at $8,850,000; the Interstate Consolidated Telephone Company of Montana, capitalized at $2,700,000; the Independent Long Distance Telephone Company of Idaho, the Washington County Telephone Company of Oregon, the Granger Telephone and Telegraph Company of Washington, the McMinnville Local and Long Distance Telephone Company of Oregon and the Lebanon Mutual Telephone Company of Oregon.

Arrangements of Telephone Pioneers.

A meeting of the Executive Committee of the Telephone Pioneers of America was held in New York City on July 24. A report was received from the Plan and Scope Committee detailing the proposed arrangements for the entertainment at the Chicago meeting, October 16 and 17, and the action of the committee was endorsed.

The meeting is to be held at the Congress Hotel, Chicago, and the business of the association will occupy the day of October 16, the business to be transacted in the forenoon. Addresses will be made by N. C. Kingsbury, Thomas A. Watson, Thomas B. Doolittle and M. J. Carney in the afternoon. In the evening there will be a play given by local talent in a down-town theater, to be attended by members, telephone officials and families.

On the second day there will be automobile rides to the various parks and boulevards, and inspection of the new telephone building and the shops of the Western Electric Company and entertainment by field sports. The usual banquet will be held on Friday evening, October 17, at the Congress Hotel. The Committee will invite the presidents, vice-presidents and general managers of all associated companies who are not members of the association.

The applications of the following members were approved by the Committee for membership:

NAME AND DATE OF ENTERING SERVICE.
James A. Ramsay, July, 1892.
James Cunningham, March, 1891.
George Y. Lawson, March 27, 1887.
Edward Thompson Fisher, March 1, 1888.
E. Preston Clifford, November, 1892.
Robert G. Tinkler, June, 1881.
John A. Hunter, December 2, 1890.
Charles M. Klingensmith, March 17, 1892.
William Hughes, 1891.
William H. Gillette, 1879.
Richard A. Heidel, February 9, 1887.
James J. Murphy, April, 1892.
Thomas M. Carter, August, 1883.
William C. Hartranft, October, 1889.
Charles G. DuBois, 1891.
Frederick C. Tomlinson, June, 1888.
Charles F. Barker, January 3, 1889.
Michael J. Burns, October, 1884.
Edwin S. Keefer, May 20, 1887.
Anthony J. Sheridan, April, 1891.
Lola M. Davenport, January, 1885.
Augusta Greenslade, July 2, 1892.
Lydia A. Facey, 1881.
Jacob S. Wiley, June 1, 1892.
John J. Gilbert, May, 1890.
James L. Hamar, April, 1892.

Water-Power Decisions on Public Lands.

In the matter of a water-power project on the Pend d'Oreille River in Northern Washington, Secretary of the Interior Lane has laid down five conditions as an ideal standard toward which to work in the making of the contract between the Government and the applicants.

1. The greater the development of horsepower the lower the charge per horsepower to be made on the part of the Government. This is intended to secure the full use of the stream.
2. The lower the rate to consumers the lower the charge on the part of the Government.
3. No charge whatever for a period of five or ten years during which the power company is finding its market.
4. Acceptance as a public utility of the state's jurisdiction over intrastate rates and service; and of federal jurisdiction over interstate rates and service.
5. Absolute prohibition of combination or monopoly and the right of revocation on the part of the Government in the event that it is established to the satisfaction of the Secretary of the Interior or the courts that such combination has been made or that prices have been fixed by agreement with competing plants.

The lower the rate charged to consumers by electrical power companies the lower will be the tax which such power companies must pay the Government for right to use the public lands and the waters of navigable streams for the development of electrical power. Secretary Lane is opposed to making the use of these waters a source of revenue to the Government, but is in favor of requiring the fullest use of the waters.

The International Power and Manufacturing Company has been granted authority to develop 350,000 horsepower under these conditions, the grant to be perpetual unless revoked for violation of its terms or the provisions of the general regulations. A maximum rate of six cents per kilowatt-hour is specified.

The company must begin work within one year, and within three years must have 50,000 horsepower developed.

To allow the United States to compete with Sweden, Norway and other countries in the manufacture of nitrates for fertilizing purposes, the company will have to pay only about 20 per cent of the regular rate for the power it uses in such manufacture.

Electrical Congress in Argentina.

A scheme is on foot to organize an electrical congress in Buenos Ayres, to which all the electrical engineers in Argentina and Brazil would be invited.

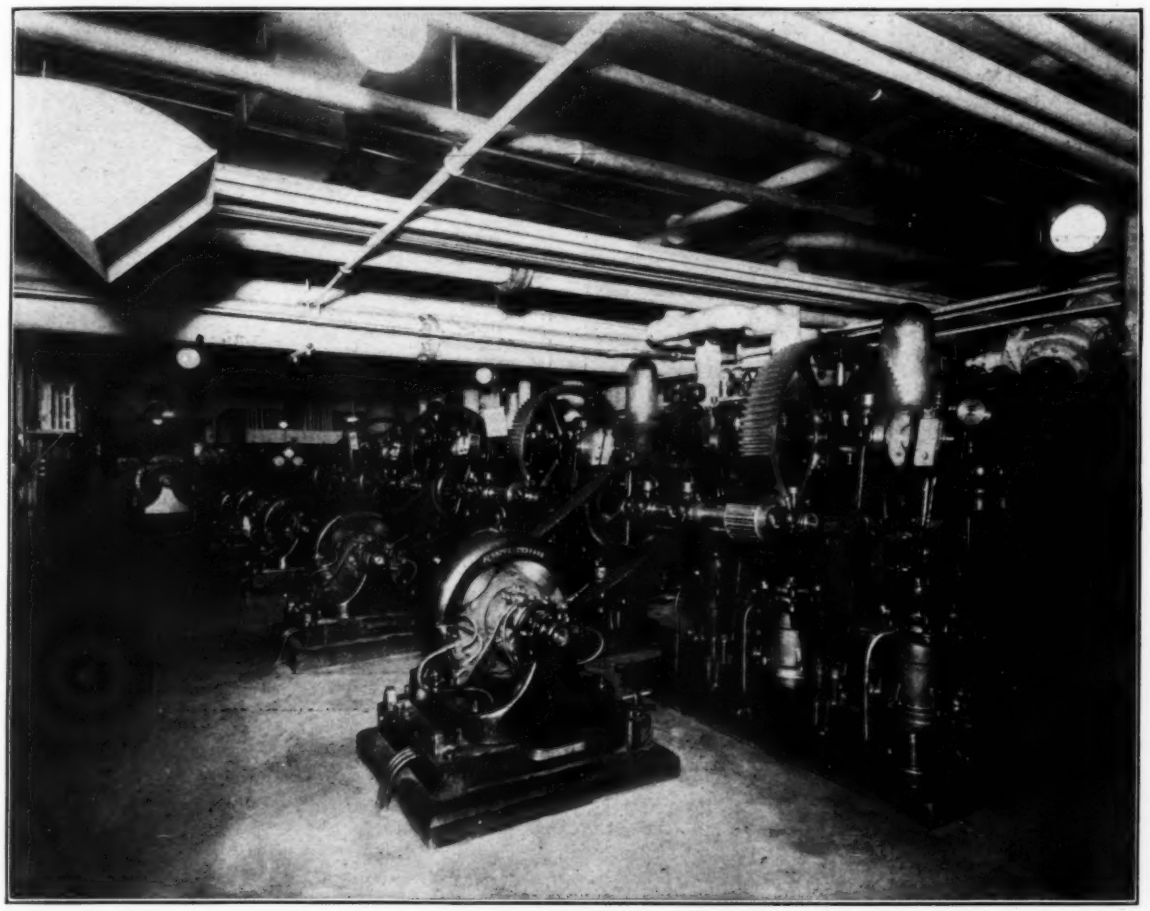
Electricity in Department Stores.

This article discusses the power requirements of elevators, refrigerating machines, ventilating fans and miscellaneous machines used in the modern department store and gives data on illumination and an outline of the best methods of comparing isolated-plant with central-station power costs.

The question as to how central-station companies in large and medium sized cities are to successfully meet the problem of isolated plants in department stores, particularly in the business area, is one of greatest interest and worthy of the closest study on the part of central-station managers. For many reasons there is no harder class of business to obtain.

With the reduction in rates by the central-station companies in the large cities to a fraction of what they were a few years ago it would seem that it should be easier to secure this business; but it must be remembered that the general layout of plants in these buildings is now of a very much higher class than several years ago. The apparatus installed is better and more efficient and the consulting engineers are striving in every possible way to install machinery that will develop energy for the price estimated in their preliminary reports, for if they do not approach these estimated figures in practice it naturally reacts on them in the next proposition they have to deal with. A number of years ago the installation of water-tube boilers was not common, while today the installation of this type of boilers is almost universal in the department stores, as is also the installation of automatic stokers, more efficient pumping machinery and a better class of engines and other apparatus.

On account of the increase in value in basement and sub-basement space owners are making such excavations and find it necessary on account of revision of the laws to install not only ample lighting facilities that are used practically continuously, but in addition to this to install heavy power-consuming, ventilating, refrigerating, vacuum cleaning and indirect heating systems. The elevator systems are requiring more power because of increased speeds demanded by the use of larger cars. All this increase in the electricity consumption of these buildings makes it more difficult for the central-station companies to secure the business on account of the fact that the fixed charges on the plant investment are no greater where a high load-factor is the condition than where the plant has a poor load-factor.



Bank of Motors Driving Elevators in a Department Store.

Elevators.

One of the most important factors in the electrification of a modern department store and one which has an important bearing on the cost of power is the elevator installation. The electric elevator is coming more into use for passenger and freight service. It is in every way superior to the old mechanical drive

and its cost and operating expense are less than the corresponding cost for hydraulic installations, this being especially true in small plants. The electric machine is more efficient, takes less space, is less complicated and requires less attendance than the hydraulic type. The usual type of electric elevator is the drum machine, on which the hoisting and counterweight cables are wound upon a drum usually driven by worm gear. The traction elevator is now coming into quite general use where high lifts and speeds are necessary. This consists of a cable drive in its simplest form with driving sheave directly connected to the armature shaft of a motor of very low speed. The cables pass under the driving sheave, then over an idle sheave and again under the driving sheave, and are attached at one end to the car and at the other to the counterweight. The two half wraps on the driving sheave will usually give all the adhesion necessary for ordinary elevator service. This can be increased for heavier duty by increasing the number of wraps of the cable. The speed of the car is equal to the circumferential speed of the driving pulley.

The Fraser or duplex elevator, consisting of two motors continuously operating an endless cable, the movement of the car being obtained by varying the speed of the motors, has been used, but not generally.

Investigations conducted in Chicago indicate that the latest development in gearless traction type elevators permits of the highest class of service, and in the case of one installation of 14 2,750-pound cars installed in a large department store investigations proved that these elevators could accelerate to their normal running speed of 550 feet per minute in five seconds and that as far as reliability was concerned they were fully equal to the hydraulic type, tests for speed being made by competent disinterested engineers.

It was found that the maximum demand on the bank of elevators in this building indicated that the momentary maximum is 16.8 kilowatts per elevator, while the average kilowatt-hours per car mile is about four, one-half of the elevators being for express service and one-half for local service. In other department stores where the entire service is local it was found that the consumption ranged from 4.5 kilowatt-hours to 8 kilowatt-hours per car mile, depending somewhat as to whether the store was equipped with sufficient elevator service. Usually the orders in stores of this class are to stop the cars at each floor. This is the reason for the high consumption and it is known that in stores where they maintain a service for up passengers in one bank and down only in another bank, that the kilowatt-hours per car mile are reduced.

When using the one-half-hour peak in determining the maximum demand the load-factors of elevators in department stores is about 35 per cent. The car-mile travel per day appears to approximate about 10.15 miles.

Arriving at the consumption and load-factor of fans and blowers in the building is a matter of determining the horsepower and hours of running and whether this load would all come at the time of the peak. House pumps rarely run at full load to exceed five hours in each 24. Vacuum cleaning systems are short-hour users and do not come at the peak at all. Public lights were found to use the maximum demand six to eight hours per day, and the connected load about four hours per day, but with the use of tungsten lamps this part of the energy consumption has been considerably reduced.

Refrigeration.

Refrigeration equipment is coming to be demanded as necessary in the large stores, where ice water is circulated throughout the building for use of patrons; cooled air used in the ventilating system in summer, and ice and cold-storage facilities required in the kitchens, meat markets, etc.

Refrigerating machines in large part use ammonia in the production of low temperatures. The ammonia is drawn into a compression chamber, and compressed to a pressure of approximately 150 pounds per square inch. The compressed gas then passes into a condensing chamber containing a series of pipes or coils over which cold water flows. Under the combined influence of the pressure produced by the compressor and the cooling influence of the water, the gas becomes liquefied. The liquid ammonia then passes into a receiver, where it is stored. From this receiver when the machine is in operation, the liquid ammonia passes to the expansion coils and there expands to a gaseous form, absorbing large quantities of heat, and performing the actual work of refrigeration. The amount of heat so absorbed or taken up is equal to the amount that was previously given up to the water during the condensation of the ammonia from a gaseous to a liquid form.

Another form of machine frequently used and in more favor with some store managers and engineers, is the carbonic anhydride machine using carbon dioxide. This machine has two special advantages at least: the absence of the smell of ammonia, and the fact that in case of fire in the refrigerating room, a safety

Single-Unit Lighting Installation.

Tungsten-Cluster Installation.

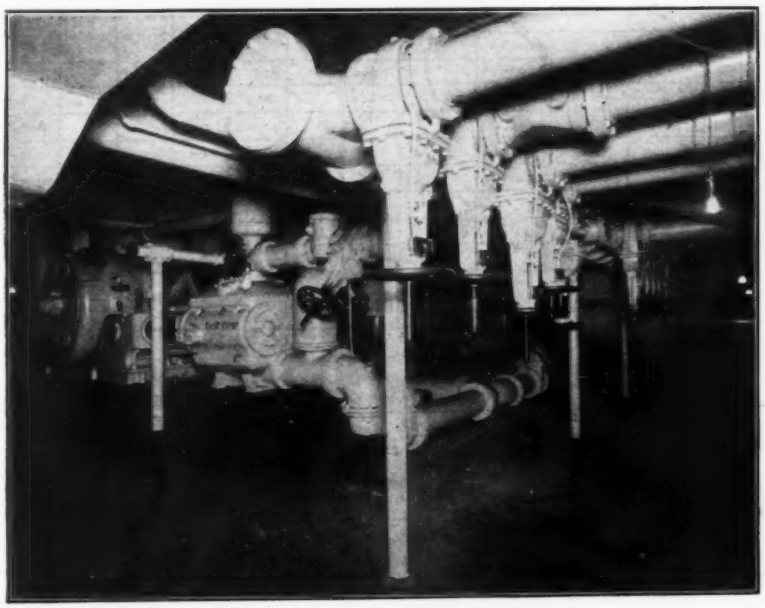
CAPACITIES OF ICE MACHINES AND HORSEPOWER REQUIRED.

Refrigerating capacity in tons per 24 hours	Ice-making capacity in tons per 24 hours	Horse-power required
0.5	0.25	1
1	0.5	2
2	1	4
3	1.5	6
5	2.5	9
8	4	13
10	5	15
12	6	17
16	8	22
20	10	26
25	12.5	32
30	15	37.5
35	17.5	43
40	20	48
50	25	60

valve opens at a slight increase of temperature, and fills the room with the gas which drives out the oxygen and stops combustion without injury to the contents of the refrigerating room.

The horsepowers given in the accompanying table are based on condensing water of a temperature of 70 degrees Fahrenheit. When condensing water of a higher temperature is used, the consumption of power will increase accordingly.

Illumination of Rothschild's Department Store.



Motor-Driven Service Pumps.

Ventilation.

To procure fresh air and to keep it in circulation is a problem of particular interest to modern stores. In summer, especially, and in inland and low sections of the country, arrangements for good ventilation become a matter of business necessity to render a building habitable during the hot months, and in the winter it is an equally important matter where a large unmber of people congregate.

For good ventilation it is not only necessary to draw in pure air, but to remove the vitiated air, and to continue this process indefinitely. A ventilating fan of the propellor type is usually fixed in a circular aperture in the wall and can be arranged as desired—either to draw in fresh air or expel bad. An exhause fan should be placed so that it discharges the air in the same direction as the prevailing wind, in order to avoid having to contend with wind pressure. The number and location of air inlets and probable effects of prevailing air currents should also be considered carefully in determining the place for the fan. Under ideal conditions the room to be ventilated should have only one inlet for air which should be at the opposite end of the room from the exhaust fan. The size of the fan to be installed, of course, depends largely upon local conditions, but roughly speaking, the 18-inch size will be found sufficient to provide fresh air for 25 or 30 persons. This allows for the provision of 2,000 cubic feet of air per hour for each occupant of the room.

In comparing the cost of central-station operation with isolated plants tor department stores the various items entering into this comparison are generally divided as follows: (1) labor; (2) coal, repairs, supplies, water, etc.; (3) energy consumption of the building; and (4) fixed charges. On the question of labor the main items of cost are generally easy to agree upon. As to fixed charges it has been found within the last two or three years that store owners are more willing to allow ten per cent for depreciation and obsolescence, five per cent for interest and 2.5 per cent for taxes and insurance. While there may be some disputes as to the ten per cent for depreciation and obsolescence the store owners are willing to allow this not so much because they believe the depreciation should be as rapid as this but because of the value of money to them.

Another item in connection with the fixed charges that is amounting to larger sums every year is the value of space. Real estate values in different communities would, of course, govern this, but in many cities the owners have no difficulty in using sub-basement space.

The last item of expense is that of coal, labor and supplies. Supplies can be estimated reasonably close, but the question of repairs, coal and cost of ash handling is one open to dispute. In several cities it has been found that isolated plants seldom are able to evaporate to exceed six pounds of water to one pound of coal under average working conditions, and in many cases they cannot attain this efficiency. Engines and generators in this class of building run under widely fluctuating load conditions. This increases the pounds of steam required per kilowatt-hour as against the full-load guarantee of manufacturers and the statements of the engineer as to the probable performances of these units. Adding to this the decreasing efficiency of engines during their life, it is not

difficult to show a consumption of 55 pounds of steam per kilowatt-hour by the ordinary high-speed engine usually installed. If a higher class of engine is to be used the fixed charges, of course, become greater, offsetting to some extent the greater economy obtained. Therefore, under the conditions central stations can show a consumption of ten pounds of this class of coal per kilowatt-hour when running non-condensing.

Where the owner insists on the use of hydraulic elevators the labor and repair items in such a plant are increased, as is also the coal consumption. The average pumps in these plants are very heavy steam users, and it is always well to emphasize this fact in reports of plant cost.

In estimating the amount of steam chargeable against heating the building and the amount required for hot water and cooking, where required, credit is given the value of the exhaust steam from the engines and other apparatus during the winter months. To this heating value must be added the coal required for generating live steam for such purposes as cooking, the operation of steam pumps and other apparatus, also the amount of live steam to be supplied the heating mains at times of low electric light and power loads, that is to say, from 7:00 p. m. to 8:00 a. m., adding also the coal for banking fires. Too much value is usually placed on the exhaust from the generators, as the peak of the load on such plants usually comes late in the afternoon when the heating requirements of the building are on the decrease, it being necessary to heat the building to the proper temperature before 8:00 a. m., maintaining the heat until the middle of the afternoon, and then gradually reducing the steam in the heating mains in the latter part of the afternoon and early evening. After that time, unless special heating part of the night hours is required, the amount of steam in the average building necessarily drops off considerably.

Having the total coal consumption, the cost of ash removal is readily estimated. As for the cost of supplies for generating plant, this item depends largely on the size of the plant and local conditions. Water can be determined closely from the coal consumption and repairs should be counted in at from one to two per cent of the value of the electric plant.

The accompanying table gives data on the electrical consumption in department stores in large cities.

Illumination.

The choice between different systems and different lighting units for department stores is generally made on the basis of relative efficiency and relative attractiveness in appearance. These are the fundamental considerations, although there are others which are also of vital importance. All lighting systems can in general be classed under one of three classifications, viz., direct, indirect and semi-direct.

In practically all lighting systems some portion of the illumination is received indirectly. In other words a portion of the illumination is obtained by light reflected from the ceiling or walls or both before reaching the plane of utilization. In direct lighting when efficiency is important it is the aim in general to make the indirect portion of the illumination small, allowing only enough light to reach the ceiling and walls to illuminate them to a low intensity, thereby preventing a gloomy appearance.

Obtaining a large portion of illumination indirectly has the following disadvantages as compared with direct lighting: (1) lower efficiency; to produce a given illumination requires about twice as much light with indirect lighting as with efficient direct lighting; (2) more rapid depreciation, due to the collection of dirt; (3) a lower degree of perspective, since sharp shadows are largely eliminated; (4) an unduly bright ceiling, which often gives an unpleasant psychological effect, especially when the opaque unit of the indirect lighting contrasts with the brightly lighted ceiling.

For the reasons cited above and since in the average department store a comparatively large area must be illuminated, it would seem that in most cases the general illumination can be obtained more economically, efficiently and with units which will be sufficiently attractive in appearance by a system of direct illumination.

(Continued on page 211.)

Department Store Data

Store	Elevators	Total Gross Floor Area	Total Gross Volume	Connected Load in K.W.				K.W.Hrs Per Year			Percentage Tung. and Tant. Lamps Wattage Basis	Total K.W.Hrs per Cu. Ft. per Year	Rate per K.W.Hr. Approx.	De-mand	Percent of Demand to Connected Load	Hours use per day of K.W. Demand	Hours use of Connected K.W. per day	Hours use of Total Connected K.W. per Year
				Light	Power	Misc.	Total	Light	Power	Total								
1	Hydraulic	400,000	5,140,000	669	266		935			856,760		1666	0277	436	46.6	6.4	3.0	916
2	18 Electric 3 Hydro Elec	352,000	3,578,000	906	432	12	1350			1,316,790		368	.0229+	500	37.0	8.4	3.8	976
3	Hydraulic	188,500	1,300,000	170	51	7	228			288,498		1757	03744	134	38.5	5.6	3.0	1002
4	40 Electric	780,000	9,080,000	944	732	6	1702			2,821,970		2317	0199	576	51.4	9.4	4.8	1481
5	Electric	264,370	4,188,600	352	288	10	650			703,296	32.69	1680	.0317				3.6	1116
6	11 Electric 1 Hydraulic	444,345	6,394,070	247	413		660	493,674	248,765	742,428	63.96	1160	0316				3.6	1124
7	Electric	471,220	7,903,000	319	490	5	814	602,203	317,277	919,490	47.90	1034	.0306				3.2	1006
8	Hydraulic	216,000	3,670,000	303	51	19	373			550,108	17.20	1498	.0345				4.8	1474
9	"	483,000	7,326,000	396	455	24	875	782,580	196,270	978,850	26.20	1335	.0300				3.6	1115
10	"	174,150	2,684,550	233	19	18	265	434,508	16,093	449,601	38.07	1540	.0367				5.2	1610
11	"	410,250	6,834,550							932,000		1365	Private Plant					
12	Electric	693,440	11,460,360							2,500,000		2441	"					
13	Steam		7,278,600							1,697,000		.2330		578		9.3		
14	28 Electric		11,000,000							2,500,000		.2272		965		8.3		
15	30 "	1,000,000	13,000,000	1273	600		1873			2,760,000				1100	58.7	8.1		1473
16	72 Electric	1,246,800	23,200,000	2081	3480		5531			6,709,300		289		2600	45.4	8.6	3.9	1235
17	"	604,000	8,829,000	529	643		1172			1,618,225		183		600	51.2	8.7	4.4	1390
18																		
19																		
20																		

Department Store Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Department store located in Chicago, Ill.

Total connected horsepower, 60.25. Total number of motors installed, 6. Average kilowatt-hour consumption per month, 4,339.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	3,189	May	3,445	September	8,320
February	2,775	June	4,094	October	3,905
March	3,566	July	5,933	November	4,111
April	2,712	August	6,663	December	3,356

Load-factor, 13 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power	Speed R. P. M.	Application.
1	20	.....	Geared to one 3,000-pound passenger elevator.
1	20	.....	Geared to one 3,000-pound freight elevator.
1	1.5	1,200	Belted to one ventilating fan.
1	17.5	900	Belted direct to one eight-ton Croeschell ice machine.
1	1	1,800	Direct-connected to one coffee grinder.
1	0.25	1,200	Direct-connected to one meat chopper.

Small department store, four floors high.

Total connected load, 36 kilowatts. Average kilowatt-hours per month, 5,880. Load-factor, 22.6 per cent.

Total connected horsepower, 20.75. Total number of motors installed, 7. Average kilowatt-hours per month, 1,123. Load-factor, 11.5 per cent.

Total lighting load, 20 kilowatts. Average kilowatt-hours per month, 4,740. Load-factor, 32.9 per cent.

Kilowatt-hour consumption for 12 months:

Month	Power	Light	Total	Month	Power	Light	Total
January	1,202	5,656	6,859	July	1,089	3,521	4,610
February	1,395	5,349	6,744	August	1,137	4,234	5,371
March	877	4,463	5,340	September	1,167	5,089	6,256
April	1,091	4,399	5,490	October	1,014	5,289	6,300
May	1,073	3,677	4,850	November	1,183	5,417	6,600
June	1,108	4,241	5,349	December	1,154	5,580	6,739

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 110 volts and 220 volts alternating current and 220 volts direct current.

No.	Horse-power	Speed R. P. M.	Application.
1	0.25	1,000	Belted direct to one potato peeler.
1	0.5	1,000	Belted direct to one dish washer.
1	0.5	1,000	Direct-connected to one grindstone.
1	0.5	1,000	Belted direct to one ventilating fan.
1	0.5	1,000	Belted direct to one ventilating fan.
1	3.5	1,800	Belted direct to one vacuum cleaner.
1	15	1,500	Direct-connected to one passenger elevator.

Department store located in St. Louis, Mo.

Total connected horsepower, 110.5. Total number of motors installed, 8. Average kilowatt-hours per month, 8,149.

Kilowatt-hours consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	7,900	May	7,300	September	9,040
February	8,150	June	7,980	October	7,260
March	8,000	July	8,610	November	6,950
April	7,310	August	8,660	December	6,800

Load-factor, 14 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts; and 220 volts direct current.

No.	Horse-power	Speed R. P. M.	Application.
1	20	720	Alternating-current motor belted direct to one 15-ton Racine Iron Works refrigerating machine.
1	5	1,800	Alternating-current motor belted to countershaft driving one 3 by 4-inch Deming triplex circulating brine pump.
1	2	1,200	Direct-current motor driving vacuum pump.
1	7.5	900	Driving air compressor furnishing air for carrier system.
1	15	.....	Geared to one freight elevator.
3	20	.....	Each geared to passenger elevator.
2	0.5	1,200	Each direct-connected to exhaust fan.

Department Store Data—Sheet No. 2.

Department store located in Chicago, Ill. Total connected horsepower, 306. Total number of motors installed, 19. Average kilowatt-hours per month, 6,319. Load-factor, 4 per cent.

Kilowatt-hours consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	4,604	May	6,114	September	6,800
February	5,108	June	6,076	October	7,000
March	5,156	July	6,434	November	9,006
April	5,300	August	6,850	December	7,384

Motor Installation.

The supply source is 220 volts direct current.

No.	Horse-power	Speed R. P. M.	Application.
6	40	300	Each geared to one 2,000-pound passenger elevator.
1	40	300	Geared to one 3,000-pound freight elevator.
1	5	1,200	Belted to line shaft driving one circular saw, and one grindstone.
1	0.5	1,450	Belted direct to one 30-volt generator.
1	5	1,200	Belted direct to one blower.
1	3	1,800	Driving one portable vacuum cleaner.
1	1	1,200	Belted direct to one ventilating fan.
2	3	1,800	Each driving one paper-baling machine.
1	1	1,875	Belted to line shaft driving six sewing machines.
1	3	1,800	Belted to line shaft driving 10 sewing machines.
1	0.5	1,070	Belted to line shaft driving one grinding machine, one edging machine, and one surface grinder.
1	0.25	1,200	Belted to one surface-grinding machine.
1	1	1,875	Belted to one lathe.

Department store in Baltimore, Md.

Total connected horsepower, 19. Total connected lighting load, 141.72 kilowatts. Total number of motors installed, 19. Average kilowatt-hours per month, 33,700.

Kilowatt-hours consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	20,420	May	42,590	September	37,430
February	27,200	June	39,180	October	36,570
March	30,960	July	36,640	November	31,780
April	37,600	August	38,100	December	25,940

Motor Installation.

The supply source is 240 volts direct current.

No.	Horse-power	Speed R. P. M.	Application.
1	10	1,350	Belted to a Connersville blower, 13 cubic feet per minute, supplying air for carrier system.
1	5	1,200	Direct-connected to ventilating fanin boiler room.
2	2	1,200	Each driving centrifugal pump in elevator pit.
1	2	1,650	Geared to lathe.
1	2	400	Direct-connected to Tromener double coffee mill.
2	2	900	Each direct-connected to 36-inch ventilating fan.
1	2	1,200	Belted to line shaft driving woodworking machines in carpenter shop.
1	1	1,650	Belted to line shaft driving eight sewing machines.
1	0.5	1,200	Driving vacuum cleaner.
1	0.25	1,200	Driving potato peeler.
1	0.25	1,200	Driving soda carbonator.
1	0.25	1,200	Driving emery wheel.
1	0.25	1,200	Driving sandpaper machine for floors.

Five one-eighth-horsepower motors are installed for driving fans.

Six hydraulic elevators running between basement and fifth floor operated by steam pumps; during a typical year 953 tons of coal were burned for heating, cooking and elevator operation.

Department store located in Milwaukee, Wis. Total connected horsepower, 95.75. Total number of motors installed, 12. Average kilowatt-hours per month, 3,372. Load-factor, 6.2 per cent.

Kilowatt-hours consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	4,040	May	3,121	September	3,459
February	3,520	June	3,437	October	3,267
March	2,880	July	3,001	November	3,622
April	3,280	August	3,511	December	3,326

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts direct current, except as noted.

No.	Horse-power	Speed R. P. M.	Application.
1	0.25	1,380	Driving one carbonator.
1	12	675	Geared to one 1,200-pound freight elevator.
3	25	800	Each driving one 2,000-pound passenger elevator.
1	2	1,350	Direct-connected to one carpet-sewing machine.
1	1	1,500	Belted direct to one 24-inch ventilating fan.
1	0.25	2,100	110-volt motor direct-connected to one grinding machine.
1	1	960	Belted direct to one dish-washing machine.
1	2	135	Driving one air pump sprinkler system.
1	1.5	1,200	Belted to line shaft driving three sewing machines.
1	0.75	470	Belted to line shaft driving three sewing machines.

Moreover, it is generally considered by most authorities that the advertising value or attractive power of a direct system is far greater than that of an indirect system. It is not meant by this, however, that exposed light sources should be used for this purpose, but rather totally inclosed units or reflectors which practically conceal the light sources in the case of incandescent electric lamps are to be preferred. It is not the purpose of a department store to install lighting fixtures for display except in those spaces that are devoted to the sale of such goods. The light units should not distract attention from the goods displayed; the object should be to provide proper illumination for the display of goods at a reasonable expense to the owner. The fixtures, of course, should be sufficiently artistic in appearance and of a character which will be in harmony with the architectural surroundings of the establishment.

The light units installed should give light which in color approaches as nearly as possible that of natural daylight so as not to distort the color of the goods displayed. There are certain classes of goods, however, which will be used almost entirely under artificial light, such as are found in the home, theater and similar places. The light under which these goods are sold should approximate that under which the goods will be used, which is in general the incandescent electric lamp.

Due to its high efficiency, the possibility of a more efficient utilization of its light by the use of properly designed reflectors, ease of maintenance and the range in sizes available, the tungsten-filament lamp has largely displaced the arc lamp for department-store lighting. While tungsten lamps do not give the same color values as are given by daylight, the approximation is close enough for most practical purposes.

The elimination of glare from brilliant sources is essential. If inclosed opal or prismatic glassware be used this effect is reduced practically to a minimum. If prismatic or opal reflectors are used they should be of a deep bowl shape so as to completely screen the lamp filament from the eye in all its normal positions. It is advisable also that the lower portion of the bulb of the lamp be frosted.

Attention should also be given to the avoidance of objectionable shadows, particularly those caused by a customer in standing before a counter, and careful attention should be given to the subject of cleaning and maintenance. Some interesting data on the lighting equipment in a typical department store were given in a paper by H. W. Shalling presented before a recent meeting of the Illuminating Engineering Society. This paper describes in detail the lighting installation in the store of McCreery & Company, of Pittsburgh, pointing out how proper illumination was obtained in each department.

Commercial Practice
Management, Rates, New Business

Utilizing Electrical Energy in the Construction of the Commonwealth Pier at South Boston, Mass.

Rapid progress has been made in the construction of the Commonwealth Pier at South Boston under the supervision of the Directors of the Port of Boston, preparatory to the inauguration of the Hamburg-American Line service in May. The pier, 1,200 feet long and 400 feet wide with three two-story fireproof sheds fronting by a head house covering a total area of about 420,000 square feet, is one of the largest in the country and will be equipped with the most modern appliances for handling a large freight and passenger business. The contractor has taken advantage of the uses of electricity in construction work and is operating two motor-driven concrete-mixing plants whose output was an important factor in the timely completion of the work necessary for the service previously mentioned. Under the terms of the contract, which was signed December 19, 1912, the lower portion of the center shed and the outside shed on the easterly side of the pier, except 100 feet near the land end, with the car trackage and necessary railroad connections were ready for use on May 1. The entire work is to be completed by April 14, 1914.

Concrete is used for the foundations of the columns, retaining walls, caps of granite sea walls and floors. Electrical energy is supplied by the Edison Electric Illuminating Company of Boston to the motors of the mixing plants, to a motor-generator set furnishing current for operating portable tools, and to arc and incandescent lamps. The mixing plants are located on the west side of the pier. One of the plants mixing a stone concrete is an Underwood installation, and the other mixing a gravel concrete is equipped with Smith mixers. The broken stone and sand employed in the former is brought either in cars or scows, and is deposited in storage piles; the gravel used in the latter arrives in scows. The cement is delivered in cars.

The broken-stone concrete plant consists of a wooden structure with overhead bins the storage capacity of which is 125 tons of sand and 250 tons of broken stone. The bins discharge their contents into measuring hoppers connecting with three chain-belt mixers installed in a row at one side of the structure. The mixers empty the concrete into steel cars running on an industrial railway located alongside of the plant and extending over the pier. Two stiff-leg derricks with bull wheels, 30-foot masts and clam-shell buckets are erected near by, each having a working radius including a railroad track, a storage pile and a bin. One with a 65-foot boom and a one-cubic yard bucket handles the broken stone, and the other with a 60-foot boom and a 1.5-cubic yard bucket handles the sand. A 52-horsepower, 220-volt, three-phase, 60-cycle motor geared to a Mead-Morrison triple-drum, double-winch hoist operates each derrick. The speed of the motors is 600 revolutions per minute. Bags of cement are delivered from the cement shed to the loading platform of the mixer house by a 20-inch belt conveyor with a capacity of 300 bags per hour when running at a speed of 100 feet per minute. The conveyor is gear-driven by a 7.5-horsepower, 220-volt, 60-cycle, three-phase motor at 1,800 revolutions per minute. The mixers are group driven by a chain belt from a jack shaft operated by a 25-horsepower, 220-volt alternating-current motor running at 1,200 revolutions per minute. The motor is mounted on a foundation at the floor level, and is fitted with a 4-inch pinion engaging with a 24-inch gear at one end of the shaft. The shaft is furnished with clutches permitting any mixer to be thrown out of service.

A general view of the plant equipped with two 0.75-yard Smith mixers is shown in Fig. 1. Gravel is discharged from the scows into a hopper by an unloading equipment consisting of the upper part of

a dredger. The hopper is located at the top of the structure and supplies a revolving screen 13 feet long and 51 inches in diameter. The screen is driven at 30 revolutions per minute through worm gearing from a 10-horsepower, 220-volt, three-phase, 60-cycle motor running at 1,200 revolutions per minute. The screened sand and gravel is deposited into bins of 100 and 200 tons capacities, respectively. A 16-inch belt conveyor, driven by a 10-horsepower, 220-volt, alternating-current motor at 900 revolutions per minute, delivers bags from a cement shed to the loading platform of the structure. The mixers are located on either side of the industrial railway running longitudinally through the center of the plant. Each mixer is gear-driven by a 15-horsepower, 220-volt, 60-cycle, three-phase motor running at 850 revolutions per minute. The motors are protected from dust by a light wooden covering. The starting compensators are fastened to the columns near the motors within easy reach of the operator. The capacity of each plant as generally operated is about 480 cubic yards per eight-hour shift.

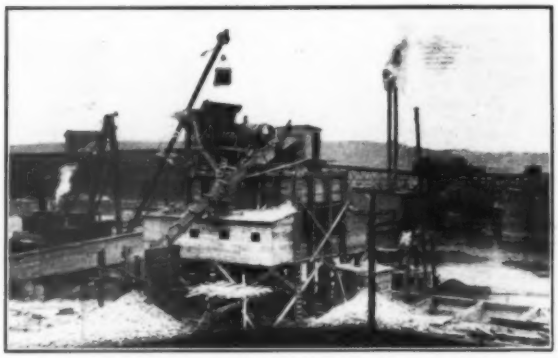


Fig. 1.—General View.

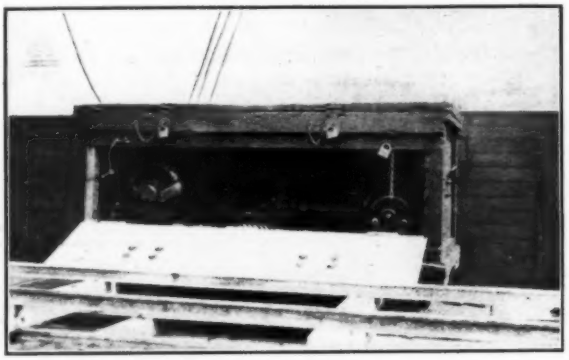


Fig. 2.—Portable Motor-Generator Set.

Fig. 2 illustrates a portable motor-generator set used by the Ogden Company for converting alternating to direct current for operating portable drills in connection with the installation of the sectionalized doors. A 5-horsepower, 220-volt, 60-cycle, three-phase motor is belted to a 125-volt direct-current generator running at 1,250 revolutions per minute. The motor is mounted on a slotted base and is provided with adjusting screws for tightening the belt. The motor is housed in a box mounted on four double casters. The canvassed top and one side of the box are hinged permitting easy access to the inclosed apparatus. Handles are provided at the ends, top and sides. A rheostat, switch and fuses are attached to the floor of the box. A cable is carried from the motor-generator set to the outside shed on the easterly side of the pier where it runs parallel to the building. Four-way distributing blocks are inserted in the line at alternating doors enabling the use of three electrically driven portable drills within a distance of approximately every 50 feet. Six drills are in use at present.

Energy from the Edison system is brought to the pier at 2,300 volts by an overhead line terminating at the double poles as shown in Fig. 3, the pressure being reduced to 220 volts by two 50-kilovolt-ampere and two 100-kilovolt-ampere oil-cooled transformers of the three-phase, 60-cycle type mounted on a wooden platform. Cutouts are provided on the primary side of the transformers. Each group of transformers is furnished with a set of secondary wires leading to a switch and meter house, 30 feet long and 9 feet wide, built around the poles. One group supplies the lighting and the other the motor load. At one end of the house an Edison service cutout and a recording wattmeter are installed with the necessary switches and fuses in four lighting circuits leading to the mixing plants, two distribution boxes in the sheds, and the lamps in the yard and offices. The equipment of the power lines, including a main switch and a wattmeter, is placed on one of the side walls of the building from which circuits lead to the motor-generator set and the mixing plants. The power circuits supplying the broken-stone concrete plant consist of lead-covered cables carried under the pier to avoid interference with the material storage piles and the derricks.

There are 65 550-watt arc lamps in the sheds arranged on five circuits; two are supplied from one distribution box and three from the other, the former being shown in Fig. 4. The boxes containing the switches and fuses are fastened temporarily to a column about 15 feet from the ground. A platform placed a few feet below the box and a ladder are provided to facilitate access to the switches. There are six arc lamps outside the shed, and about 150 110-volt incandescent lamps used throughout the work.

The contractors are H. P. Converse & Company, of Boston, Mass.

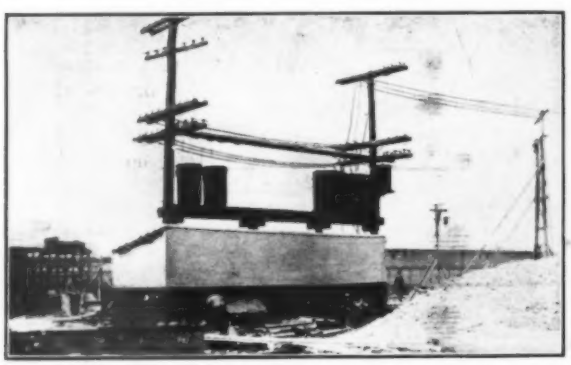


Fig. 3.—Transformers for Lighting and Power.

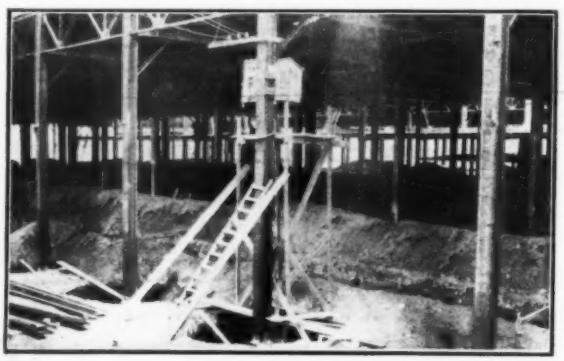


Fig. 4.—Distribution Box.

Fan Billboards in Toronto.

The Toronto Electric Light Company has erected about 20 billboards in prominent locations throughout that city advertising the electric fan.

The design, which was originated by the company's publicity department, is a composite effect derived from the cover designs of two Westinghouse fan catalogs. The object sought was to produce a design which at first glance would impress the observer with a sense of coolness. It is believed that this object has been achieved. The artists who executed the design were very successful in getting the wave effect, which with the blue-sky background sets off the sign very effectively. The electric fan, which is painted in its true colors, is of such size as to be visible at a considerable distance.

ELECTRIC FAN TIME IS HERE!
½ CENT AN HOUR KEEPS YOU COOL!
TORONTO ELECTRIC LIGHT CO. LIMITED
"At Your Service" 12 Adelaide Street East.

Toronto Billboard.

The accompanying illustration shows one of these billboards, but owing to the lack of color fails to give the full effect of the original.

Baltimore Window Display Attracts Attention.

For several weeks, beginning June 21, thousands of Baltimoreans broke into their daily routine of marketing and shopping long enough to take a good look into the Lexington Street and Park Avenue show window of the Consolidated Gas, Electric Light & Power Company.

The reason is made partly plain by the illustration herewith, which shows a wax dummy Goddess of Liberty lighting the world with the modern illuminant—the Mazda lamp. Alternating with this wax figure was a man, dressed to imitate the dummy. When the imitation dummy or the "Mechanical Doll" as he is termed, was out of the window, his place would be taken by the real dummy.

Display Window of Consolidated Gas, Electric Light & Power Company.

It was amazing as well as enlightening to mingle with the people outside as they expressed their beliefs and doubts as to the genuineness of the "Mechanical Doll" who for 15 minutes at a time would hold an almost immovable pose, even though an occasional fly with an inquisitive turn of mind might explore the paint and powder on his face. Not even an eyelash would move. In their attempt to outstare the "Mechanical Doll" some of the observers would assume a pose almost dummy-like and certainly more ludicrous. It was only until the 15-minute pose was finished, and the demonstrator stepped out of the window that those who thought him a real wax dummy found they were mistaken.

The exact advertising value of the display is hard to estimate. Lamp sales showed a healthy increase and numerous inquiries about Mazda lamps were satisfactorily answered.

The display brought many into the store and certainly created the feeling that Mazda lamps set the standard, and made the way easier for future sales. Since lamps of all sizes, from 15 watts to 500 watts, were displayed, the window undoubtedly held for everyone who saw it a message of better light and more light.

The cost of dressing the window was very low, as but few fixtures and ornaments were needed. The Goddess of Liberty costume was rented. The standard held in the hand of the Goddess was topped by a 500-watt lamp. The groups of lamps scattered about the window were made up of standard sizes. The flags were fluttered by electric fans.

At this point it is appropriate to mention that the Gas & Electric Company has been using the "Mechanical Doll" in connection with displays of irons, fans, vacuum cleaners and washing machines. These displays never failed to draw the crowds, as in all of them, the demonstrator cleverly imitated the mechanical movements of an automaton. The windows were particularly effective in causing comment when a real dummy and the "Mechanical Doll" were displayed at the same time, as it was almost impossible to tell which was which, especially when, on the next day, the places were reversed.

Even if sales had not shown the increase they did, the company would have still been satisfied, as these displays attracted widespread attention to the new office, which was better equipped than ever to serve the public.

The display was devised by Dorsey R. Smith, of the company, who will be pleased to receive from manufacturers suggestions and display material suitable for attracting public notice to his show windows.

Rate Reduction in St. Louis.

The Union Electric Light & Power Company has heretofore been charging

a monthly minimum rate for residence lighting amounting to three cents per lamp connected, the charge in no case being less than $1.00. Beginning with the month of August this minimum has been reduced to 50 cents to all customers.

Rates Lowered in New London.

The Connecticut Power Company has reduced rates in New London, Conn., one cent per kilowatt-hour for residence lighting. For commercial lighting the new rate is 12 cents for the first 50 hours' use of the connected load and 8 cents per kilowatt-hour for the remainder. In addition there is a discount of one cent for payment within ten days. The minimum bill is $3.50 per month per kilowatt of connected load.

Electric Show at Reading.

The Metropolitan Electric Company, Reading, Pa., has opened an electrical show with the purpose in view of showing the housewives of Reading and vicinity the value and the many uses of electrical devices and the economic labor-saving importance of electricity in the home. The Keystone Gas Fixture Works, of Philadelphia, has an artistic and handsome display of gas, combination and electric fixtures. The Electric Construction Company has a general exhibition of wiring and electrical appliances, motors, dynamos, etc. The wiring and decorating of the entire display has been the work of The Keystone Electric Company.

Denver Company Boosts Fan Sales.

In an attractive circular recently-distributed to its customers, the Denver Gas & Electric Light Company sets forth in an interesting manner the merits of the electric fan. A special summer rental offer providing for a small monthly charge for the rent of a fan during the summer months has met with popular approval and has resulted in many fan sales. Invariably the customer keeps the fan after learning of the comfort it provides.

The Commonwealth Edison Company Announces Mazda Lamps at Reduced Rates.

The Commonwealth Edison Company, Chicago, Ill., has announced that after August 1 it will supply tungsten Mazda lamps in sizes of 100 watts and over free to its customers whose contracts include lamps. Tungsten Mazda lamps of all other sizes will be supplied to such customers at the following schedule of reduced rates: 10-watt, $0.28; 15-watt, $0.25; 25-watt, $0.18; 40-watt, $0.16; 60-watt, $0.14.

Results Obtained from Active Electric Cooking Campaign.

That actual results may be accomplished by carrying out energetic electric cooking campaigns has been fully demonstrated during the past few months by the commercial department of the Great Shoshone & Twin Falls Water Power Company, of Twin Falls, and the Southern Idaho Water Power Company, of Pocatello, Idaho. Early in the summer of 1912, the new-business department of these two companies commenced a campaign of advertising, publicity, and education of the public in the use of electricity for cooking purposes. This was not done, however, until many tests had been made to determine the most reliable electric cooking devices that were available. The newspaper advertising was followed by a rapid succession of circular letters, tending to further interest the public in the advantages of the electric range over fuel ranges. Public demonstrations of electric cooking were held, and the people turned out by the hundred. At one exhibition in Twin Falls, over 1,000 people visited the display rooms in one day, and each one was served with a small portion of one or more daintily prepared, electrically cooked foods. The demonstrations were followed up by a well planned solicitation for the sale of electric ranges among the consumers.

During the fall of 1912, about 60 complete electric ranges of various sizes were sold. A carload (125) of No. 7 Simplex ranges was ordered during the winter and practically all of the shipment has already been actually sold or spoken for. Five hotels and several restaurants and bakeries during the past six months have discarded all kitchen fuel, and are using electricity exclusively for all cooking and baking purposes. The greatest difficulty experienced thus far in the sale of electric ranges is the fact that the customers have no means of disposing of their fuel ranges. Were the people able to dispose of their fuel ranges at anything like a reasonable price, there would be no difficulty in selling a thousand electric ranges during the current year. The campaign of advertising and publicity has been very fruitful, and the people are not only interested, but they are thoroughly convinced that the electric way is really the best.

The two companies referred to have adopted a rate of 2.5 cents per kilowatt-hour for current used for domestic cooking, and a guarantee rate schedule as follows for commercial cooking:

COMMERCIAL COOKING RATES.

Monthly Guarantee per Kilowatt Connected.	Rate in Cents per Kilowatthour.
$1.50	2
2.00	1.5
2.50	1.4
3.00	1.2
3.50	1

There has been found to be a marked diversity-factor to be considered in determining the actual revenue obtained from electric cooking installation. This is especially true in the case of domestic electric range equipments. It is reasonable to consider three diversities, one due to the non-coincident use of all the ranges connected, one due to their being a separate switch for each heating element, and one due to the three-heat arrangement on each individual element. The maximum demand of the Simplex ranges used in Idaho is cut down by the use of a switch so arranged that the oven and broiler cannot both be connected at the same time. By this arrangement, the maximum demand of the No. 6 range is reduced to 3,215 watts and of the No. 7 range to 3,510 watts. This has been found to work little or no hardship on the one using the range, and is somewhat of an advantage to the electric service company. From the consumers' records of the companies it has been found that the average revenue from the domestic cooking ranges installed prior to April 1, 1913, is $3.89 per range per month.

In another town where the rate is 3 cents per kilowatt-hour, the average monthly bills of three families using Hughes No. 40 ranges were $5.88, $2.75 and $4.45. Three other families using Hughes No. 30 ranges averaged $2.91, $3.32 and $3.56. A small hotel with the latter type averaged $5.74.

The New Albany "Booster."

The Booster, the house organ of the Louisville & Northern Railway & Lighting Company, United Gas & Electric Company, and other public service companies of New Albany, Ind., has completed two and a half years of work, the thirtieth monthly issue having just come from the press. The paper has a type page 8 by 5 inches in dimensions, and usually includes about 20 pages, the only advertising run being that of real-estate concerns and others having a direct bearing on the development work encouraged and exploited by the paper. The organ also is of value as a chronicle for the doings of the Boosters' Club, a live organization of employees of the companies. Though the latter has taken a summer vacation, *The Booster* continues to appear monthly, and is doing its part to create an esprit de corps among those in the company, cement friendly relations with the public and help develop the communities served by the companies.

Sterilization of Milk.

A favorable report upon the electrical sterilization of milk has been made by J. M. Beattie, of Liverpool University. The electric method is said to be preferable to sterilization by heat.

Electrical Construction

THE KNIGHT PUBLIC FIRE-ALARM SYSTEM.—II[1].

By E. E. Moore.

Open-Circuit System.

Having described such apparatus as calls for special attention, we are now in a position to consider the working of the systems as a whole.

Fire-alarms may be broadly described as either open or closed-circuit systems. Fig. 8 shows the principle of the lay-out for fire-alarm points with the Knight two-wire open-circuit system. Any number of points can be joined up one after another on a single circuit. Likewise any unmber of circuits may radiate out from the station, each circuit having new alarm-points added to it as demands arise. This diagram also shows various call-bell groups running (in the case of a non-resident brigade) to the various firemen's houses.

Fig. 9 gives the lines and box connections for circuit. A.

Fig. 10 gives connections for two call-bell groups with telephones.

Fig. 11 gives connections for the station apparatus.

In each of the call-boxes (Fig. 9) is the code drum, the extension circuit-breaking drum, and the electromagnet; the last mentioned, unless it is energized, holds up the clockwork after the handle has been pulled. It is proposed to consider the working of the system under every condition likely to be met with.

(*a*) *When a Point is operated.*—The clockwork rotates the code drum and circuit-breaking drum. The latter first disconnects both lines from all points farther away from the station than the point operated on this circuit. Two code contact-springs are then earthed at the code drum, thus allowing current to flow from the station along both lines and through the electromagnet coils. The code drum continuing to rotate, the circuit to the station is thus intermittently earthed and broken. The result of this at the station board can be seen by referring to Fig. 11.

The two lines become common after passing the test keys, the path of the current being through the circuit-changer operated by the drop-flap annunciator, through the annunciator electromagnet winding the top contact of the control-relay armature, through this armature to the electromagnet of the alarm relay, and then through the earth indicator, the battery ,and back to earth. Directly the armature flap drops, its electromagnet coil is cut out, the line current being switched on to another segment of the circuit-changer, and from thence in series through each of the other circuit-changers on the board to the telephone speaking-key, and then direct to the alarm relay. The pulling of a transmitter han-

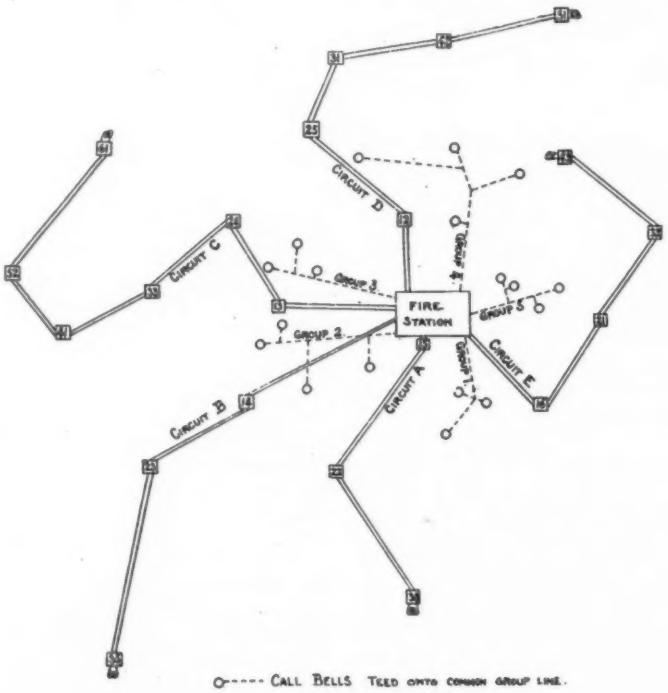


Fig. 8.—Fire-Alarm Circuits.

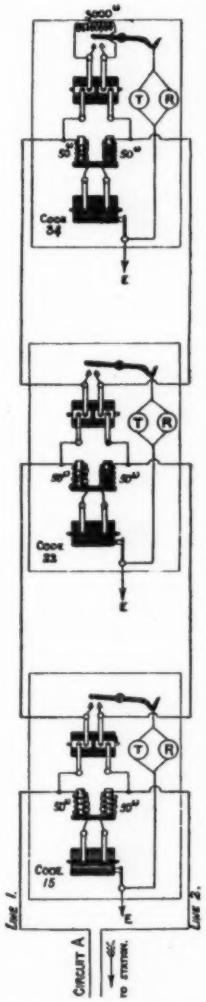


Fig. 9.—Box Connections.

1 From the *Journal of the Institution of Electrical Engineers.*

dle therefore will ring the alarm-bell at the station, first with a series of regular intermittent warning rings and then with a code ring. The ink recorder joined in shunt with the alarm-bell automatically starts and stops itself. It records every operation of the alarm relay. The record of a complete alarm-signal is shown thus:

(Code 231)

The annunciator, therefore, at once discloses the circuit on which the alarm has been given, and the code gives the identical point operated on that circuit.

(*b*) *Two or More Points on One Circuit Operated at or About the Same Time.*—As there are a number of alarm-points on each circuit, and the point operated on that circuit is only recognized by its code signal, it is obvious that means must be provided to meet the contingency of one or more points being pulled at or about the same time, otherwise a confused erratic ring would result at the station were this state of affairs not anticipated.

When an alarm-point is operated, all boxes farther away from the station (as we have before seen) are electrically cut off, and no current can reach them until connection is again made at the extension circuit-breaking drum, when the alarm at the post operated nearer to the station has finished its call. If a box therefore is operated whilst one nearer to the station on that circuit is operating, the clockwork is held up by the catch on the electromagnet, and no further manipulation of the pull-handle will affect this. The point to notice is that the clockwork is held up almost immediately after the handle has been pulled, and with the code contact-fingers earthing on the first metallic segment of the code drum. When the nearer box has finished its signal, and the extension lines are again joined up, allowing battery current from the station to operate the electromagnet and thus liberate the clockwork, the signal of the box that was till then held up will automatically come into the station. Now supposing box 22 is operated, and whilst running another point (say box 15) nearer the station is pulled. Directly this is done, box 22 is cut off, its signal ceases, and the alarm from box 15 comes into the station. But the code of box 22, although it may be interrupted at any part of its signal, is not lost at the station. It will be remembered that the code-wheel revolves twice for each complete alarm. If box 22 is interrupted before the completion of its first code-signal, then it is held up at the end of the first revolution of the code-wheel; and when the lines are again joined through to it by the completion of the signals of a nearer box or boxes, then it automatically sends through and records its complete repeat intermittent, and code signal. If, on the other hand, box 22 is interrupted after the completion of its first code, the clockwork runs down and the remainder of the signal does not come in. This is immaterial, as the first intermittent and code signal has already been received and recorded.

(*c*) *Two or More Points on Different Circuits Operated at or About the Same Time.*—When an annunciator flap is dropped at the station, this closes a local circuit, which energizes the control relay. The common lead from all the annunciator windings through which the line current first comes, is carried to the normal contact-maker of this control-relay armature. Therefore, when an annunciator-flap is dropped, current is cut off from

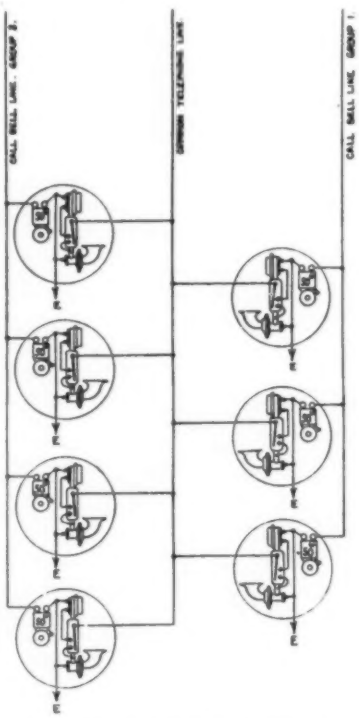


Fig. 10.—Call-Bell Connections.

all other lines; and if another point on another circuit is operated, it cannot drop its annunciator-flap and send its signal until the flap that is down has been replaced. When this is done, any point on any other circuit which has meanwhile been operated, but held up, will automatically come in. There is another contingency to provide for under this heading. Supposing points on two or more different circuits were to have their handles pulled at the same identical moment. Then all of those circuits would drop their annunciator-flaps together. What is more probable to happen than this, is for points on two or more other different circuits to be operated at any time during the period that a flap on another circuit is down, and the signal coming in from the alarm first pulled. When the first flap is replaced, the other flaps on those circuits which are earthed will simultaneously drop. If no provision were made, the calls would come through from the different circuits under these conditions, intermingling and causing confusion. This, however, is simply remedied.

When the circuit-changer breaks the line current from the annunciator winding after dropping the flap, it switches the circuit on to each of the other circuit-changers in series, and finally on to the alarm relay. Thus with three circuits, A, B, and C, even if all drop their indicating flaps together, current is cut off from B and A, and only the signal on C will come in. When C is replaced, current is still cut off from A at B, and only the signal on B will come in. When B is replaced, the signal on A will come in. It will be noted that the point operated nearest to the station on a circuit takes precedence over other points which might be operated about the same time on that circuit, which is obviously a distinct advantage for the fire-brigade.

Faults.

(*d*) *An Earth Developing or Extraneous Current on Line.*—This must necessarily show itself on the earth indicator. If it has a high resistance the deflection will be small, and will not affect the working results when an alarm is operated. The indication, however, is there, and steps may be taken at the earliest opportunity to locate the leak and restore insulation. If, however, the resistance of this earth decreases and goes on decreasing, it will arrive at a resistance when it will allow sufficient current to pass to actuate the annunciator, drop its flap, and ring the alarm-bell, thus giving an audible signal that the circuit has a bad fault on it. This ringing of the alarm-bell, however, will either be erratic or continuous, according to the nature of the earth. It cannot possibly be mistaken for a fire-call which gives a regular intermittent ring followed by a code ring. There are two test keys to each circuit. By pressing separately, first one and then the other of these keys over the flap which has dropped, the line which has the earth on it is discovered, as the bell stops ringing when it is disconnected from the line at fault. The line disconnecting-screw is then taken out, and the circuit is again in thorough working order on its remaining line. Extraneous current on the line may have the same effect as an earth.

(*e*) *A Line Broken and Earthed.*—The foregoing description for an earthed line also explains the state of affairs when a line is broken with the broken end earthing.

(*f*) *A Line Broken and Not Earthing.*—This is the only big fault which does not automatically make itself known at the station on this open-circuit system. It can very easily be tested for, however, by means of the two testing keys provided on the station board for each

circuit. By referring to the connections of a series of alarm-points on a circuit, it will be seen that a high resistance is connected across the two extension terminals of the last box. When the two keys of a circuit are simultaneously pressed at the station, a closed circuit is formed from a test battery, through one line, through every alarm-point across the contacts on their extension-line breaking drums, through the high resistance at the end of the line, back along the other line, through every alarm-point again by way of the other contacts on the extension-line-breaking drums, on to the station board, through the line test-indicator, and back to the test battery. This test need only take a couple of seconds for each circuit, and if the lines are intact the indicator pointer reflects to "lines in order," about three-quarters of the way across the scale. It should be noticed that with a line broken, even if it were undiscovered, the circuit is still quite in working order on its remaining line. Only in the very rare event of both lines becoming broken at once would this affect the working of the alarms, and even then those alarms on the station side of the breaks would ring-in if operated.

(*g*) *Two Lines in Contact on a Circuit.*—This would not affect the working of the alarms in the slightest, provided that there was no bad earth on the line, as of course an earth on one line would also earth the other under these conditions. The use of the test keys will discover, however, if any circuit is short-circuited, as when the two keys on a circuit are depressed, the current instead of going to the extreme end of the line and returning through the high resistance from there, will have a lower-resistance circuit to complete, and consequently the test indicator will deflect past "lines in order" to "lines shorted." The one operation of these test keys, therefore, discloses at once the fact if the lines are in contact or if either is broken.

(*h*) *Lightning.*—Lightning striking the lines will very probably drop an annunciator-flap at the station and give a short ring on the bell. No further ring, however, follows. The annunciator having dropped, a buzzer is actuated until the flap is replaced.

(*i*) *Telephonic Communication.*—Speaking from any alarm-point to the station is provided for by means of a central battery at the station and without the use of any induction coils or condensers at the posts. Where the telephones are kept in the post in preference to having a jack only there, the transmitter is fixed and the receiver normally hangs on an automatic switch-lever. This lever, when relieved of the weight of the receiver, puts the two lines on the extension side through the microphone and receiver in parallel, and thence to earth, thus dropping the flap of that circuit at the station and ringing the alarm-bell there continuously. The duty man in answering the call presses his speaking key, which breaks the alarm circuit, putting the lines through to the telephone battery, and thence dividing to the primary of the induction coil and microphone on one side, and the secondary of the induction coil and receiver on the other side, and on to earth, when oral communication is established.

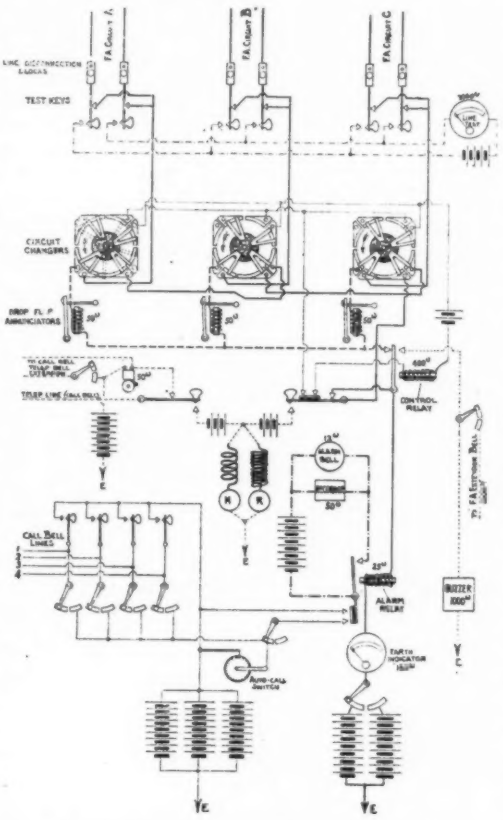


Fig. 11.—Connections for Station Apparatus.

The telephone at the alarm-box, being connected to the extension lines, is automatically cut off while an alarm is being sent in. Thus anyone snatching the receiver off its switch-hook directly the door opens would not affect the alarm signal in any way, as the microphone and receiver are not connected up to the station until the alarm has been finished. If another alarm on that circuit should be operated while telephonic communication is being carried on, the duty man will get the distinct intermittent signal and code on his telephone receiver. If an alarm on another circuit is started, the signal from same drops its circuit flap and gives the duty man an intimation that an alarm-point has been operated.

A high-resistance buzzer operated by the alarm battery gives warning at the station so long as an annunciator-flap is down and no signal is coming in. An unmistakable audible warning is thus given to the duty man if he has neglected to replace a flap.

Call-Bells.

With non-resident brigades the men have to be summoned from their respective houses, immediately an alarm is received at the station. The same thing holds good, of course, with resident firemen, as they have to be summoned from their quarters; but a description of the necessary arrangements for calling out a non-resident brigade will cover both purposes.

The whole of the men are not called out to a first alarm, the number depending upon the extent of the fire, and the circumstances of the case. The whole of the men are therefore split up into certain groups, say, A, B, C, D, and E, and these five groups are controlled by five corresponding circuits running out from the station board. Those groups that are required to turn out for a first call are switched on to the alarm-circuit by means of their group switches. Any signal now coming from an alarm-point will not only be heard and recorded at the station, but will be sent on to these call-bell lines by means of their circuit or circuits being closed by the lower contacts of the alarm-relay. These firemen will receive the unmistakable fire-alarm signal consisting of a regular intermittent ring, and further (what is claimed as a distinct advantage on this system) each of those men will also get the code ring of the point operated. If this point should therefore happen to be nearer to his house than the fire station, a fireman can proceed direct to the alarm-point in question.

If, however, the alarm is received at the station by some other means than an alarm-point being operated, the alarm to the call-bells has to be given from the station, but in a manner which leaves the firemen no doubt that it is a genuine fire-call, and not a telephone ring, or a fault on line. This is arranged by installing an auto call-switch on the switchboard, and across the call-bell contacts of the alarm relay. This switch is merely a clockwork mechanism with a contact drum, which intermittently puts the call-bells through the battery to earth, and thus when running sends out the characteristic intermittent ring to the men. The pulling of the lever on this auto-switch

winds up the clockwork, and releasing of the same allows the contact wheel to revolve with the aforementioned results.

In some cases it is thought advisable to install telephones at the firemen's houses. The arrangements shown in Figs. 10 and 11 provide for a common line to be run to all the firemen's houses. This is used only for speaking on, or calling up the station from any of the houses. This latter is automatically effected when the telephone is taken off its switchhook, the circuit thus being earthed through the microphone and receiver, consequently ringing the telephone bell at the station. The pressing of the call-bell telephone key will then put the station-telephone into circuit with the calling-up house. A man at any of the alarm-points can ask the station to put him into communication with any of the firemen's houses. The station would then call up the required house, and when he had obtained an answer would also depress the alarm telephone key. Both telephone keys thus being used together would then put the alarm-post into direct telephonic communication with the desired house.

The call-bells in the houses are used as the means of calling attention if the station wishes to speak to any of them. As, however, there is more than one bell on the circuit closed by its respective calling-up button, a prearranged simple code of signals is devised, say 1, 2, 3, and 4 long rings, respectively, if four houses are on the circuit. Each house need then only answer to its own call.

A better arrangement, irrespective of expense, is to have each call-bell on a separate circuit from the station board, controlled by a two-way switch and ringing-up button. Any man who is away on leave, or from any other reason is not on the active list, need not then be called up with his group. Likewise any possible combination of the men can be called out at once. The telephones can, of course, work on the same lines as the call-bells, but a separate speaking-key or jack would be required for each circuit.

(To be continued.)

Underwriters Provide British Inspection.

The Underwriters' Laboratories, Incorporated, has appointed Heap and Digby, engineers, of London, England, as British representatives to perform inspection of material and fittings of British manufacture conforming with the National Electrical Code. Such material, when of approved construction, will undergo inspection when intended for export to Canada or the United States and thereby make inspection unnecessary after arrival at its destination. Heretofore British-made electrical fittings, of which a large number are used in Canada, could only be inspected after arrival.

CONTROL WIRING ON SWITCHBOARDS.

By E. W. Dullea.

The following is an account of the way the control wiring was done on the switchboard of a substation I worked on recently, and I think it will be of interest to other men engaged in this line of work. It was a railway station and the equipment consisted of three 1,000-kilowatt converters, three air-cooled transformers, oil switches, blowers, etc.

We took some pieces of strap iron and twisted each piece so as to turn a section in the middle of the piece with its

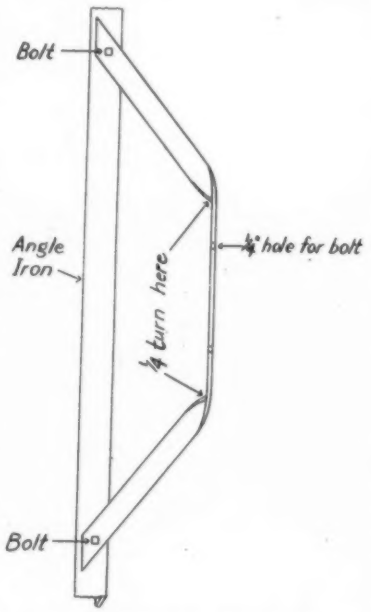


Fig. 1.—Angle-Iron Framework.

width at right angles to that of the ends of the bar, after which these pieces were bent and drilled and attached to the angle-iron framework of the switchboard as shown in Fig. 1. We then made cleats for holding the wires out of pieces of hard rubber. A series of holes was drilled through the piece of rubber,

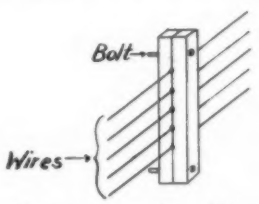


Fig. 2.—Hard-Rubber Cleats.

the number of holes being equal to the number of wires to be supported and the diameter of the hole somewhat less than the outside diameter of the wire. When a hole had been bored through each end of the piece of rubber at right angles to the direction of the holes first bored, the block was sawed into halves along the line bisecting these first holes, and the cleat was complete and ready for the wires. (See Fig. 2.) The end holes were used to fasten the hard-rubber cleats on the strap-iron racks; when the bolts had been set up properly the wires were held firmly in place.

In installing the wires, when we got to the end of a run we did not wind the wire around the cleat, as I have sometimes seen it done; but, pulling it through the last cleat about half an inch, we threaded it with a 4-32 die and screwed on a small rubber knob having a tapped brass center. This protects the end of the wire, looks neat and keeps the wire taut—as it is screwed up it presses against the cleat and tightens the conductor.

There was some discussion regarding the advisability of grounding the iron framework of the switchboard on this job; but we finally decided not to ground it. We set a piece of 6-by-6-inch timber in the floor; the angle irons were bolted to it, being supported at the top by pieces of three-quarter-inch pipe run to the wall, with insulating joints in them. This insures positive insulation of the entire board.

Iron Conduit for Alternating-Current Lines.

In a recent paper presented to the *Elektrotechnischer Verein*, L. Bloch discusses the conditions attending the running of cables carrying alternating current in iron conduit where the return line is not included within the same iron covering. It is found that the inductance of the pipe not only causes considerable impedance in the circuit, but that the eddy currents and hysteresis produce a marked wattage loss which raises the temperature of the conduit and this limits the carrying capacity of the cable to a lower value than it would otherwise have.

The general conclusions are stated as follows: When single-phase cables are laid singly in iron conduit serious troubles are likely to arise if the currents exceed 50 amperes and even at lower limits. The most notable effect is a rise in temperature, in addition to which the dropping voltage and the loss of power may have a serious effect upon the satisfactory working of the installation.

The investigation was occasioned by a serious case which occurred in Berlin, where a large number of heavy conductors carrying polyphase current were laid singly in iron conduit. Although the German regulations provide that alternating-current cables which are either iron-armored or laid in iron pipes must contain all the wires of one circuit in the same covering, the regulation has been neglected.

Annual Convention of Missouri Contractors.

The Thirteenth Annual Convention of the Electrical Contractors' Association of the State of Missouri was held at St. Louis, July 12. While the attendance was not so large as it was hoped that it would be, the meeting was an enthusiastic and successful one. Convention headquarters were established at the Maryland Hotel, but the meetings were held in the rooms of the City Club.

The business session was called to order at ten o'clock in the morning, with L. E. Reed, of St. Joseph, president of the Association, in the chair. Much routine business was transacted.

A special feature of the session was a paper on "Voltage Drop in Inside Wiring and its Effect on Lighting" by C. Edward Fee, a representative of the National Quality Lamp Division of the General Electric Company.

Group of Missouri Contractors at the St. Louis Convention.

This paper consisted largely of a report on some tests which had been conducted with a view to finding the drop in voltage between the service switch and the lighting outlets in the wiring of buildings of various types. The author also spoke of the importance of good voltage regulation on efficient lighting and brought out very clearly the importance of ample allowance of copper in interior lighting circuits. The paper proved to be a very interesting one to the contractors present.

The election of officers resulted in the re-election of all the officers who had been serving the Association during the past year. These are: L. E. Reed of St. Joseph, president; W. F. Koeneman of St. Louis, vice president; A. J. Burns of Kansas City, secretary; A. Penn Denton of Kansas City, treasurer; W. J. Davies of Kansas City, sergeant at arms; Ernest S. Cowie of Kansas City, director.

The place of the next meeting is to be determined sometime before December of the current year.

In the matter of entertainment nothing was omitted to make the convention a success. There was a luncheon at which fifty members and guests were present. The luncheon over and a group photograph having been taken, all those present were taken in automobiles to witness a baseball game between St. Louis and New York teams. The conclusion of the game was followed with an automobile trip to Sunset Country Club, a distance of 21 miles, where a bountiful dinner provided by the St. Louis contractors was partaken of.

Not content with the entertainment provided for the visitors on Saturday, the St. Louis members drove their guests through the principal parks and boulevards of the city on Sunday, making a stop at the Century Boat Club House, where a splendid Dutch lunch was served. Monday was spent visiting places of interest around St. Louis, until 3:45 in the afternoon, when the electrical contractors boarded a train for Chattanooga to attend the Annual Convention of the National Electrical Contractors' Association. Everybody went away complimenting the St. Louis electrical folks on the splendid manner in which the convention people had been taken care of.

Among the electrical contractors attending the convention, the following were noted: Squire Electric Construction Company, Kansas City, Mo., represented by W. J. Squire; E. S. Cowie Electric Company, Kansas City, E. S. Cowie; American Electrical Equipment Company, Kansas City, Charles A. Pierson and Jay H. Ross; Denton Engineering Company, Kansas City, A. Denton; Economy Construction Company, Kansas City, A. J. Burns; G. G. Burkholder Electric Company, Kansas City, G. G. Burkholder; American Electric Company, St. Joseph, L. E. Reed; St. Joseph Electrical Company, St. Joseph, W. L. Caneday; Frank Adam Electric Company, St. Louis, Fred B. Adam; William A. Carrao Electric Company, St. Louis, Geo. W. Carrao; Eclipse Electric Company, St. Louis, Mr. Schmidt; Guarantee Electric Company, St. Louis, W. F. Koeneman; F. E. Newbury Electric Company, St. Louis, William Dennison; Shiras Electric Company, St. Louis, Oliver Shiras; Charles J. Sutter Electric Company, St. Louis, Charles J. Sutter; Van Nort Electric Company, St. Louis, E. C. Van Nort; Van Nort Brothers Electric Company, St. Louis, Sam A. Van Nort.

Among the Contractors.

The Barker-Cole Electric Company, of Lansing, Mich., has recently finished the installation of the electrical work in the new Garden Theatre in that city.

The Spokane Engineering Company, of Spokane, Wash., and NePage & McKenna, of Seattle, were recently awarded the contracts for the electrical work on the new Davenport Hotel, which will approximate $21,000.

The La France Electric Construction & Supply Company of Toledo, O., has just finished the wiring of the new office building and show rooms of the Toledo Railway & Light Company. This includes an unusually fine installation of semi-indirect lighting and outlining of the exterior of the building.

The La France Company, which was organized last December with F. E. La France as president and general manager and Otto G. Knigge as secretary and treasurer, has enjoyed a very satisfactory business.

Wisconsin Electrical Contractors' Meeting.

The Electrical Contractors' Association of Wisconsin is to hold a summer meeting from August 7 to 12 on board the steamer *Georgia*, which will make a trip from Milwaukee to Sault Ste. Marie and return. The secretary of this association is Albert Peterman, of Milwaukee.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president,
59 Deerfield Street, Hartford, Conn.

H. S. WYNKOOP, vice-president,
13 Park Row, New York, N. Y.

WILLIAM LINCOLN SMITH, secretary and treasurer,
Concord, Mass.

JAMES E. COLE, Representative on Electrical Committee of
National Fire Protection Association, 11 Wareham Street, Boston, Mass.

J. E. LATTA, assistant secretary,
603 South Dearborn Street, Chicago, Ill.

Executive Committee

EUGENE N. DAVIS, chairman, Brookline, Mass.

Frank R. Daniel, R. P. Strong, Henry A. Knight, C. H. Fletcher, Washington Devereux, James B. McCarthy, James H. Fenton, R. J. Forsyth, C. W. Mitchell, A. W. Hopkins, G. W. Perry, George L. Collison, T. H. Fritts, A. H. Soper, T. W. Bowry, F. G. Hartwell, A. A. Moffitt, Thomas D. McColl

Secretary's Message.

Milton S. Nettleton, Room 3, City Hall, New Haven, Conn., and E. L. Duff, inspector for the United Electric Light & Water Company, Southington, Conn., have become members of the Association.

There were recently thirteen members in arrears to the amount of three years' dues each, and two to the amount of four years. Notices were sent to each in regular form twice, and then they were reported to the Executive Committee, which decided that they should be dropped from membership. In order that they might not claim that they had no warning, a final notice was sent registered, and return receipt requested. At present the number of delinquents has been reduced to five, but, although the registration receipt has come back to me, I have heard nothing more from these five. It is earnestly hoped that the few remaining will respond, as after the end of this month I shall have no option in the matter.

Can any member give me the correct address of A. H. Apperson? I fail to reach him at the address on my mailing list.

The following question has been sent me by one of the members of our Executive Committee, and I am printing it here instead of sending it out in a circular as is customary, with the hope that it will bring me some letters of comment from the membership at large as well as from others interested.

"In reading Rule 30a of the Code today; it seemed to me that there is an unfortunate omission here which surely must have been unintentional. By a comparison of the conditions under which this rule requires: (a) insulating joints, and (b) canopy insulation, it will be seen that joints but not canopy insulation are required in the following cases: (1) In fireproof buildings wired with exposed conduit, cable or metal molding, contact of canopy with wall being prevented, at least where the conduit is supported on wooden cleats or runways and is not itself necessarily in contact with the fireproof wall or ceiling; (2) in other than fireproof buildings when gas piping to outlets is run exposed and canopy is set up against the exposed pipe, or when some fixture is supported from grounded metal work besides metal walls or ceilings—for instance, when it is attached to an I-beam or to a column.

"If this interpretation of the Code is correct, should not the attention of the Code Committee be directed to the matter?"

The Secretary admits that the above matter is new to him and that he has read it with considerable interest; and he trusts that the members will be so good as to let him have their views promptly on the subject, and assures them that good use can be made of these, as the discussion of such a question can only result in a closer study of the Code, and benefit to us all.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Motor Switch and Cutout.

Question 233. Is it permissible to protect a single motor installation with the service entrance fuses and switch, if the fuses and switch are on the meter board opposite the motor or in sight of it?

Answer 1 (Y). Rule 8*c* seems to cover this question.

Answer 2 (F). Yes.

Answer 3 (M). Yes.

Answer 4 (B). Every motor installation should have its cutout and switch independent of the service entrance fuses and switch. In this city we hold the company supplying current responsible for the condition of the service cutout and switch. We would not be able to do this, however, if the occupant of premises or the owner of motor installations was privileged to interfere with service cutout and switch at will.

Answer 5 (P). There is nothing in the Code to prohibit the use of a service switch and cutout as a motor switch and cutout. In the case of small motors, however, a difficulty may arise through the use by the power company of fuses that are too large properly to protect either the motor line or the motor itself.

Answer 6 (D). Where the fuses protecting a single motor installation are installed in close proximity to motor, we would consider this adequate protection and not require an additional fuse at the motor.

Answer 7 (J). Yes.

Answer 8 (O). The arrangement described in this question does not violate any National Electrical Code rule.

Answer 9 (C). Yes. Rule 23*a* would answer for the installation of a single motor, and Rules 8*c* and 23*f* could be waived in this case, provided the motor and starting box were near the point of entrance.

Answer 10 (S). Yes; see Rule 8*c*.

Answer 11 (I). Yes; if the motor is

the only load on the service switch and fuses. If other apparatus were connected to the same service, however, the motor would have to have its own switch and cutout; otherwise it might be necessary to use service fuses too large for the proper protection of the motor in order to keep these from blowing when the machine was running under full load and all or even part of the other apparatus was in operation at the same time. (See Rule 8*c*).

Answer 12 (E). I so interpret the rule, which reads, "The switch and rheostat must be located within sight of the motor." No reference is here made to the location to the cutout. It is assumed that the installation consists of but one motor. If the installation consisted of several motors, each should have a separate cutout

Answer 13 (U). I know of no rule in the Code to prevent the use of the service switch and cutout for the motor in this case. But the electric lighting company would probably object to having the switch so used; this company would doubtless require that the service switch be kept closed all the time, so as to keep current continuously on the potential coil of the wattmeter in order that correct light-load readings might be had.

Answer 14 (N). Yes. There is nothing in the Code to prevent this. Nevertheless, local requirements or the regulations of the supply company regarding accessibility of service fuses, sealing of services, etc., might prevent such construction.

Another Case of Motor Fuse.

Question 234. Suppose the motor of above question were on say the fifth floor of a building and the service fuses and switch were in the basement. Would it be permissible to use a switch at the motor and allow the service fuses to protect the outfit?

Answer 1 (Y). The switch at the motor would be approved if the main was fused according to Table A, Rule 18.

Answer 2 (F). Yes.

Answer 3 (M). Yes.

Answer 4 (B). The answer to Question 233 practically covers this question. A motor switch and cutout should be installed near the motor.

Answer 5 (P). If switch control is provided at the motor, answer to Question 233 will cover this case also.

Answer 6 (D). Assuming that the motor is remotely located in respect to the entrance fuse, I should deem it necessary to provide fuse protection at the motor. The entrance cutout should be fused with a capacity sufficient to protect the wiring, and the auxiliary cutout fused to a capacity sufficient to protect the motor.

Answer 7 (J). Yes, provided the service fuse is of proper size to protect the motor and its circuits.

Special consideration should be given to the probability of overfusing, which might be greater in this case on account of the desire to avoid the extra work involved in going to a remote point to replace blown fuses. Good engineering would require fuses near the motor, of a smaller capacity than those installed in the basement.

Answer 8 (O). This arrangement is in accordance with the requirements of the Code, provided the rheostat also is within sight of the motor.

Answer 9 (C). No; Rule 23*a* must be complied with as to point of entrance. Rules 8*c*, 19*a* and 23*f* would also have to be kept in mind. Aside from Code rules, the placing of fuses in remote parts of the building for the protection of motors is bad practice. A reason why it is not good engineering is that the part of the building where the fuses are located might possibly be occupied by other tenants than the one using the motor, and hence it might be hard to gain admittance to the premises to replace a blown fuse or to see what damage had been done by the blowing of one.

Answer 10 (S). Yes; see Rule 8c. Rule 23, Sections *b* and *c* could not be left out of consideration, however.

Answer 11 (I). Rule 8*c* specifies that the switch and rheostat must be located within sight of the motor unless permission is obtained to put them elsewhere, but it does not state that the fuses must be installed here. We should rule that the fuses could be installed where the wires entered the building. It is understood, of course, that this might be a little awkward because of the necessity of going from the motor to this point to look for a blown fuse. As in Question 233, we should rule that no other load besides the motor could be connected to the circuit.

Answer 12 (E). Yes, if the switch is within sight of the motor.

Answer 13 (U). I should say it was permissible but poor practice not to have a fuse nearer the machine.

Answer 14 (N). The same considerations apply as in Question 233, with the additional one that it is extremely poor engineering unless there is a suitable type of circuit-breaker on the motor panel. As a municipal officer, I would not allow it.

Conduit Terminal Fitting.

Question 235. In the wiring for a variable-speed alternating-current motor there may be about twenty wires between motor and controller. Would it be permissible to pull all the wires into one conduit, and what type of a terminal fitting would be approved?

Answer 1 (F). Yes. A conduit outlet box with separately bushed openings for each wire would make an approved terminal fitting.

Answer 2 (M). It is permissible under Rule 26*p*. Use bushings for terminal fittings.

Answer 3 (Y). The Code does not cover this question, but in this district we would allow the twenty wires in one conduit, same to terminate in a gutter and wires to be brought out through Federal bushings.

Answer 4 (B). We should consider it permissible and proper to run all the wires between motor and control in one conduit, and where there were about twenty wires, as stated in the question, we would consider an approved bushing suitable.

Answer 5 (P). All control wires should be drawn into one conduit, as they form parts of the same system. The terminal fitting might preferably be a bushing plug of hard maple boiled in paraffin. If this is not practicable, a standard metal pipe bushing should prove acceptable, but in this case care must be taken not to bend the wires too sharply over the bushing.

Answer 6 (D). Wiring for variable-speed alternating-current motors we would consider as complying with the Code requirements where all the wires are pulled into the same conduit. These should be amply large to accommodate them without crowding. The conduit should terminate in approved junction boxes, and each conductor should be protected by flexible tubing from junction box to motor or controlling apparatus.

Answer 7 (J). Code Rule 26*p* prescribes that "the same conduit must not contain more than four two-wire or three three-wire circuits." I do not believe, however, that this rule can be construed to apply to the case in question. If the intention had been simply to prohibit the placing of more than nine wires in one conduit, it would have been easier

to state the rule in that way than as it is now worded.

We would approve the installation in one conduit of all the wires between motor and control, and would require as a terminal fitting, a special box of standard metal construction with a separately bushed hole for each wire leaving the metal enclosing system.

Answer 8 (O). According to Rule 26*p*, which requires all wires of an alternating-current circuit in the same pipe, it would seem to be necessary to place all wires between motor and controller in the same conduit, and grant special permission, if it is judged that the limit of four two-wire or three three-wire circuits is exceeded. Probably the best terminal fitting would be a special box with the proper number of holes each equipped with an approved insulating bushing.

Answer 9 (C). Rule 26*p* prohibits the use of more than nine wires of the same system in any one conduit. However, if the distance were not too great and there were not more than two large bends in the conduit, I would permit all the twenty wires to be pulled into one pipe. I would insist on double-braided wires between the motor and the controlling device and would require the terminal fittings to comply with Rule 59*c*.

Answer 10 (S). Yes; Rule 26*p*. As to the terminal fitting, two Type C and one Type E taplets, or a similar fitting, with seven-hole covers might be used. A steel box with bushed holes would also make a good fitting.

Answer 11 (I). Yes, if the conduit is of the proper size. With so large a number of wires as this, and with a motor of any of the lower voltages we should require only a bushing on the end of the conduit, to prevent the abrasion of the insulation there. The construction could be improved by filling the end of the pipe with an insulating compound after the wires were installed.

Answer 12 (E). The second paragraph of Rule 26*p* sets the limit at four two-wire or three three-wire circuits to a conduit. There are approved terminal fittings which will accommodate eight wires. However, if all of the wires were of one polarity, I would be inclined to permit the number specified in the question to be placed in one conduit, and would insist on the use of an approved terminal bushing.

Answer 13 (U). I think it would be permissible to pull all the wires into one conduit, as they are all parts of the same circuit; and, as there is no fitting on the market that will take twenty wires, I think a bushing would be permissible.

Answer 14 (N). The wires should all be in one conduit, and for a terminal fitting I would accept a well filled hardwood block, suitably bored, or a simple well bushed terminal with the wires carefully fanned out to terminal screws.

Inspection in Louisville.

The electrical inspection department of the Kentucky Actuarial Bureau, of Louisville, Ky., which handles the insurance rates of the state for the fire-insurance companies, is being reorganized, additional men having been added to the force. A department head will be appointed in the near future.

The inspection work in Louisville has been put on a fee basis, heretofore having been handled free of charge. The result has been that the city inspectors, two in number, have been flooded with calls. It is probable that the number of municipal inspectors will be increased in the near future in order to handle all of the work. The chief complaints as a result of the volume of work uninspected are from the realty men, and they are urging the employment of larger forces.

Among the Supply Men

The Austin Post, published by M. B. Austin & Company, Chicago, for July, appears in a new dress, under the hand of a new editor, John Godfrey Robel. The front cover is a reproduction of the Queen of the Inland Seas, the "Seeandbee"—Galvaduct used exclusively. The contents of this issue are very interesting—away above par.

On Friday of last week, a party of Chicago jobbers journeyed to Evanston to play a best ball and sweepstakes. Franklin Overbagh and F. N. Boyer were hosts. The party included W. W. Low, Electric Appliance Company; M. B. Austin, M. B. Austin & Company; N. G. Harvey, Illinois Electric Company; F. M. Pierce, Manhattan Electrical Supply Company; Thomas C. Ringgold, Central Electric Company. Added starters were W. H. Bauer, American Ever Ready Company; A. L. Millard, Westinghouse Electric & Manufacturing Company; W. H. Colman, General Electric Company; William Grady, Faries Manufacturing Company, Decatur, Ill.; F. R. Bryant and A. A. Gray. Mr. Bauer played a great game, making a low gross of 77, followed by Overbagh, with a low gross of 80. These players, however, lost under penalty, as both Millard and Grady had deceived Handicapper Overbagh into giving them exorbitant allowances. "Billy" Low who is rapidly becoming a terror to the seasoned ones, made a 92, and hereafter will play from scratch. There is some talk of forming an Electrical Golf Club. Any one with ideas should get in touch with Ever Ready Bauer, our nifty little "Bogey Beater."

Last week the Illinois Electric Company, Chicago, cleaned house, had the front windows washed and redecorated the walls and wainscoting and swept under Nate Harvey's desk. Also had the sign regilded. The job was finished on Sunday, so as to have things sweet and clean on Monday. Early on Monday morning a watchman got Nate out of bed to tell him that the front windows of the Madison street store had been shot full of holes. Nate made sure that the holes were not big enough for anyone to crawl through and went back to bed. Investigation later on disclosed that some miscreants had discharged a broadside of steel slugs into the front of the store, practically destroying all six of the big plate windows.

The Capitol Electric Engineering Company of Lansing, Mich., which formerly did both an electrical supply and contracting business has recently separately established its contracting business as the Electrical Equipment Company. The Capitol Company now does an exclusively jobbing business and has a well organized sales force covering Michigan.

Public Service Commissions

MASSACHUSETTS.

Mayor Fitzgerald of Boston has written the Massachusetts Gas and Electric Light Commissioners, calling attention to the price of electricity furnished by the Edison Electric Illuminating Company and claiming that it is too high. The Commission is asked to grant a hearing on the matter.

The mayor states that after paying dividends of 12 per cent, a surplus of $616,212 exists. In view of the fact that the price of electricity for light, heat and power enters largely into the question of the success or failure of different business enterprises, it is of the utmost importance that the price of electricity be reduced to the lowest possible figure consistent with a reasonable dividend to stockholders.

Figures showing the financial results for the year ending June 30, together with statistics of the company's customers and service rendered, have been issued from the office of the company. The detailed annual report will be issued early in the fall, the requirement being that it shall be in the hands of the Commission by September 10. Net earnings for the year were $3,641,675, an increase of 6.61 per cent over the previous year, despite the reduction in rate from 11 to 10 cents per kilowatt-hour, effective March 1, 1912. It is stated that the large increase in output and economies in operation have more than offset this reduction.

The number of lamps and motors connected on June 30, compared with previous years, were:

	1913	1912	1911	1910
Incandescent lamps	1,972,872	1,766,618	1,605,659	1,432,407
Arc lamps	12,039	11,652	11,544	10,919
Motors, horsepower	93,175	78,733	69,419	57,094

Customers number more than 52,000, and the population of the area served is over 1,000,000, as compared with 600,000 in 1885.

NEW JERSEY.

The Board of Public Utility Commissioners has dismissed the application of the West Jersey & Seashore Railroad Company for approval of a lease of its property to the Pennsylvania Railroad for a term of 999 years. The reasons given for the denial are that the terms of the lease and its duration are such as to make problematical the authority of the Board in the future to control the issue of securities and the rates of the company.

NEW YORK.

The Public Service Commission for the First District has approved an agreement with the Interborough Rapid Transit Company for the reconstruction and temporary operation of the Steinway Tunnel. This tunnel, which extends under the East River from Forty-second Street, Manhattan, to Long Island City, Queens, has been built for some years but has never been operated owing to the fact that it was not completed in the time specified by the franchise, and the owners never obtained the right to operate it. It was built by the New York & Long Island Railroad Company, the stock of which was owned by the Interborough Rapid Transit Company, and in the Dual System contracts the latter company agreed to transfer the tunnel to the City of New York for a consideration of $3,000,000, although the cost of it was about $10,000,000, in consideration of its lease for operation in connection with the rest of the new subway system. These contracts provide for the extension of the tunnel in Manhattan to Times Square, where it will connect with the existing subway, and its extension on the Queens side to the Queensboro Bridge Plaza, where it will connect with the Astoria and Corona rapid transit lines. The contracts also provide for its temporary operation pending the completion of these extensions.

PENNSYLVANIA.

Governor Tener signed the bill creating a Public Service Commission in Pennsylvania last Saturday. The new law abolishes the State Railroad Commission and provides for a new commission of seven members having broad powers over utility corporations and public-service activities of municipal corporations, including the regulation of rates, service and extensions. Approval of the Commission is not required for issuing securities, but another law in this state provides that securities shall be issued only for money, labor, or property actually received. Capitalization of franchises is forbidden, except to the amount actually paid therefor.

WEST VIRGINIA.

The Public Utility Commission of West Virginia has begun work and opened offices at Charleston. The members of this commission are V. L. Highland, chairman, of Clarksburg; Charles H. Bronson, of Huntington; Howard N. Ogden, of Fairmont; and Wade C. Kilmer, of Martinsburg.

WISCONSIN.

The application of the Fort Atkinson Water and Light Commission for authority to increase the rates for electric service charged consumers outside the corporate limits of the city of Fort Atkinson, has been dismissed by the Wisconsin Railroad Commission. It was held that the reason advanced by the city for such an increase, namely, that the consumers affected are not city taxpayers and should therefore pay more for receiving the benefits from the service rendered by the municipal plant, should not be urged in favor of the petition, in the sense that the tax burden upon citizens within and without the corporate limits would be equalized by such an increase. By owning and operating its own utility, however, a municipality may promote the welfare of its residents and grant its consumers certain advantages which they would not receive if served by a private plant, and the Commission was of the opinion that a municipality might well refuse to grant these advantages to those of its consumers who had no share in the risks of the plant. It was therefore held to be justifiable for a city to differentiate between the rates charged to consumers within and without the city. Attention was called to the fact, however, that a municipality must not impose increased rates upon non-resident consumers unless such rates could be legally imposed by a private utility under similar circumstances, nor would such increased rates be legal unless justifiable in themselves on account of the expenses of the plant or of the particular service rendered. On this criterion, the Commission made a careful analysis of the cost of service, using a tax rate of 1.5 per cent and an interest rate of 4 per cent when computing the cost of city service, and an interest rate of 7.5 per cent when arriving at the cost for non-

resident service. Inasmuch as the actual revenues from commercial lighting were found to be in excess of the cost based on the 7.5-per cent interest rate, the Commission held that no reason existed for increasing the rates to non-resident consumers. Because no request was made for a decrease in rates, the Commission could order none, but schedules were worked out and recommended which differentiate between city and non-resident consumers along the line laid down by the Commission in its opinion. In urging the adoption of the rates recommended, attention was called to the fact that the present schedule is partly regressive in form and is inequitable as between individual consumers inasmuch as it takes into account only the quantity of energy consumed by each. The schedule of rates recommended for city consumers is as follows: primary rate, 10 cents net per kilowatt-hour for the first 30 hours' use per month of the active connected load; secondary rate, 6.5 cents net for the next 60 hours' use of the active connected load; excess rate, 4.5 cents net. The corresponding rates for non-resident consumers would be 12 cents, 8 cents and 5.5 cents respectively. The division of consumers into classes according to the percentage of their connected loads which is active follows the general plan laid down by the Commission in previous decisions.

The Commission recommended an increase in the power rates for all power users and prescribed the following schedule for city consumers: a fixed charge of 50 cents net per active horsepower connected plus a meter charge of 3.5 cents net per kilowatt-hour. The corresponding rates for out-of-town service are 60 cents and 4 cents respectively. The active connected load is to consist of 90 per cent of the first 10 horsepower, 75 per cent of the next 20 horsepower, 60 per cent of the next 30 horsepower and 50 per cent of all over 60 horsepower. The city was ordered to purchase all meters now owned and used by consumers receiving current or to pay such consumers a reasonable rental for the meters owned by them. The present practice of charging a meter rental to consumers who do not own their meters is ordered abolished and a minimum bill of 60 cents for resident and 75 cents for non-resident consumers substituted therefor.

A reduction was recommended in the rates for street lighting and a schedule prescribed therefor. The decision provides that if any change be made in the present rates, with the exception of the charge for meter rental, which must be made, all of the schedules recommended be adopted.

THREE-WIRE GENERATORS VERSUS ROTARY BALANCERS.

By Alan M. Bennett.

The advantages and economies resulting from the use of three-wire direct-current distribution are well known, also the methods for furnishing current to such systems; but a knowledge of the relative merits of these systems and their underlying principles is not so generally possessed.

It is proposed to give here an outline of the principles of operation of three-wire systems employed in present-day practice, and by comparison to show the advantages and disadvantages of each, with respect to regulation, equipment, etc. To try to show that any one system is superior to another under all conditions, or should be given preference over another, would hardly be possible, as the relative values of any two systems can only be brought out fully when they are considered with reference to the conditions under which they be installed and operated. The final decision as to the system to be employed for any particular case must therefore be left to the engineer making the installation.

Of all the various methods that have been devised for obtaining three-wire distribution, the greater number have possessed features that sooner or later have led to their abandonment. Lack of efficiency, an undue amount of care during operation, large floor space required, high first cost and maintenance, have all been factors which have contributed to their elimination, and it is worthy of note that some of these undesirable features have operated to offset decided advantages otherwise possessed by these systems. Two methods only remain in general use, the three-wire generator, and the rotary-balancer system, and practically all three-wire installations made in recent years have employed one or the other of these systems.

The Three-Wire Generator.

The three-wire generator is built in two types. The best known and most widely used of these consists of an ordinary single-voltage generator, adapted to operate in connection with an autotransformer, or balance coil, as it is termed. The generator is wound for the main voltage of the system, usually 250 volts, and the third-wire voltage is obtained by means of the balance coil through its connection to the armature of the generator. Two collector rings are mounted on the shaft of the machine, and each is connected to the armature winding at points of opposite potential, forming a single-phase connection. The balance coil, consisting of a single winding on a laminated iron core, has its terminals connected to the collector rings through brushes. From the middle point of this winding a lead is taken off to the third wire or neutral of the system.

The current in the neutral due to the unbalanced load may flow in either direction, depending on which side of the system is more heavily loaded, but in either case this current is divided in the balance coil, one-half flowing in one direction, and the other half in the opposite direction. The resistance of the coil is the only opposition to the flow of this current, and since it has opposite directions around the core, its magnetizing effect is zero. The magnetization of the core produced by its winding through connection to the armature, therefore remains constant, no matter what amount of unbalanced current is passing through the coil. The latter, being wound on a laminated core, has a high inductance. It is subjected to an alternating potential from the armature, and has generated in it a counter electromotive force. For this reason it does not short-circuit the armature, but exerts a choking effect on the alternating current to which it is subjected. This is not interfered with by the passing of the useful current through the coil, as we have seen that the magnetizing effect of this current is zero.

The middle point of the transformer, from which the neutral is taken, is always at a potential half way between that of its terminals, and thus serves as the source of the half voltage for the system.

A better distribution of the neutral current in the armature is obtained by a two-phase connection to the latter. In this case four collector rings are required, and a balance coil for each pair of rings. These coils are interconnected at their middle points, and the neutral is taken off from this point of common connection.

A three-phase connection with three collector rings is also used, the three balance coils being connected in star and their free ends taken to the collector rings.

In the three cases noted, all of which are in general use, the balance coils are separate from the machine, and are contained in cast-iron cases filled with oil. They can be placed in any convenient location, and leads taken from them to the machine.

A modification of this construction consists in building the balance coil so that it can be conveniently mounted with the armature on the shaft. The terminals of the coil are tapped directly to the armature winding, and a connection is made from its middle point to a single collector ring, the neutral wire being taken off from this ring. The connection of the balance coils to the armature can be single-phase, two-phase or three-phase, but in any case only one collector ring is required.

A type of three-wire generator which has come into general use in recent years, while somewhat similar in principle to that just described, differs from it in that the voltage for the third wire is generated by an auxiliary winding, laid in the armature slots, beneath the main winding. One end of this is tapped to the armature, and the other taken to a collector ring, from which the neutral of the system is led off. Between the points of connection to the armature and collector, this winding has one-half the number of turns that are in the main winding, in series between any two sets of brushes. As many of these windings are tapped to the armature as will utilize the available space around the latter, and they are distributed in such a manner, that the average flux cut by them is uniform.

At certain positions of the armature, it can be seen that the voltage generated by this winding is one-half that generated in the main winding, by reason of the relation of the turns in the two. At other positions this winding will generate a proportionately less voltage, but the deficiency will be made up by the main winding, so that the voltage existing between one of the main brushes and the collector ring, will be found to be one-half the terminal voltage as before. This can be understood when we consider that the third-wire voltage must be the sum of the voltages existing in the auxiliary winding, and that part of the main winding, between the point where the former is tapped to the latter, and one of the brushes.

In order that the three-wire generator may be self regulating, even though one side of the system is completely unloaded, the series fields are connected so that alternate poles are in the circuit from either side of the armature. For parallel operation two equalizers are necessary, one for each of the series-field circuits.

The Rotary-Balancer System.

This system, as now almost universally used, consists of a standard two-wire generator, across the mains of which is connected a motor-generator set, or rotary balancer, as it is termed. This latter is composed of two similar machines with their shafts coupled together, and their armatures connected in series. The neutral is taken off at the point between the two armatures, and the free ends of the latter are connected to the mains of the system. Each machine is wound for one-half the voltage existing between the outer mains, and the combined capacity of the two in amperes is made equal to the unbalanced load of the system.

The action of the balancer can best be illustrated by considering its most simple case, that of shunt-wound machines with their fields in series across the outer mains.

On balanced load, or with no load on the system, the two machines run as motors in series, the only current taken being that necessary to supply free losses. The voltage at the terminals of the two machines is alike, and as both have the same field strength, they generate like counter electromotive forces. As soon as the load on the system becomes unbalanced, the voltage on the heavily loaded side falls, while that on the side with the lighter load rises. The pressure at the terminals of the two machines is now different. Both will continue to run as motors, the machine on the more lightly loaded side taking more current and tending to increase the speed of the set, while the current taken by the machine on the heavily loaded side decreases as the voltage on that side continues to fall, until, at the point where the counter electromotive force exceeds this voltage, the current reverses in direction, and the machine operates as a generator, being driven by the other, which continues to operate as a motor. The generator half of the set now furnishes current to its side of the system, at the same time raising the voltage and tending to restore the voltage balance between the two sides. The motor acts as a load on the main generator, the combined motor and generator currents equalling the unbalanced load.

If the load unbalance occurs on the other side of the system, the motor and generator action of the set automatically interchanges. Either machine may therefore at one instant be running as a motor and at the next as a generator, depending on which side of the system is more heavily loaded. From the foregoing it is seen that the generator action of the set, and consequently its balancing effect, begins when the counter electromotive force of one of the machines exceeds the voltage applied at its terminals. Various methods of field winding and connection have been devised to effect this result at all loads within the range of the set, and to insure stable operation, or freedom from excessive speed increase on load.

The voltage regulation afforded by the shunt-wound balancer can be improved by crossing the fields, that is by connecting the field of each machine across the opposite side of the system. The motor field is thus brought under the influence of the voltage on the generator side of the system, with the result that the speed of the set increases with increase of unbalanced load. At the same time the generator field is strengthened by being across the voltage on the motor side, and the net result is increased voltage from the generator, with a given unbalanced load. But even with this increase in voltage, satisfactory regulation will not be obtained, and recourse must be had to compound-wound machines to effect the desired result. The series turns on the fields must be connected to oppose the shunt field in the machine operating as the motor, and to strengthen the shunt field of the generator. The effect of load on the set therefore, is to raise the speed by weakening the motor field, and to increase the field flux of the generator, with a net result of increased voltage from the generator, as in the case of the shunt-field connection described.

The series field can be connected in circuit in relation to the load in various ways, the most common methods being as follows: (1) series fields of both machines in the neutral circuit; (2) series field of each machine in series with its armature; (3) series fields crossed, that is, the motor current passing through the generator field, and the generator current through the motor field.

Of these, the first and third will be found to give the best results. The second method, where the field of each machine is connected in its armature circuit, is likely to result in unstable operation, due to excessive weakening of the motor field with increasing load. As the motor current is much in excess of the generator current, the differential action of the motor field is greater than the compounding action of the generator field. A higher speed of the set is therefore necessary to maintain voltage balance than where the fields are connected in the neutral and each is influenced by the same current, as in the first method. On excessive overload the condition may arise of the shunt field being overpowered by the series, and the direction of rotation of the set being reversed. This is termed "spilling over."

Where the series windings are crossed, voltage balance is maintained with less increase of speed than with either of the other methods. The generator field is influenced by the motor current, and the compounding effect is therefore greater than before. At the same time the action of the generator current on the motor field does not result in such high speed from excessive field weakening of that machine.

Comparison of Systems.

On comparison, the two systems described show wide differences with respect to regulation, switchboard equipment, application to existing plants, and ease of installation, and it is principally on a consideration of these features that the choice of a system rests.

Regulation in a three-wire generator depends chiefly on the voltage drop in the balance coils or auxiliary winding.

It is determined at the time the machine is designed, and after this is a fixed quantity, not capable of adjustment. It will vary with the amount of unbalanced load on the machine, being greatest with maximum unbalance, and decreasing almost proportionately with a decrease of this load. It is seldom that three-wire generators are built to regulate more closely than two per cent of the voltage across the outer mains, when carrying full unbalanced load, which in the case of a 250-volt system, would give a difference in voltage between the two sides of 5 volts. This difference will be still further increased by the action of an overload on this part of the system.

With the balancer set, regulation is obtained by adjustment of the shunt and series windings of the machines comprising the balancer, in a manner similar to voltage adjustment in a two-wire generator. In a shunt-wound balancer where an attendant is almost always at hand, this is accomplished by means of the field regulator, as the load varies. With a compound-wound set, regulation is automatically obtained by the action of the series windings. Properly designed and adjusted balancer sets will maintain a voltage difference on the two sides of the system of less than 1.5 volts, when operating within the load range for which they are designed. They are capable of heavy overload, and even under this condition this regulation will be closely maintained.

The switchboard equipment for protecting three-wire generators is exceedingly elaborate when compared with that required for the two-wire generator and balancer set. Circuit-breakers probably occasion more complications than any other piece of apparatus used in this connection. They are generally placed in circuit after one of the schemes outlined herewith:

(1) A two-pole breaker is placed with a pole in each main from the generator, between the armature and the series field. This necessitates, (*a*) mounting the breakers on or near the machine, and running five cables, including the neutral, to the switchboard, or (*b*) mounting them on the switchboard and running a cable to each breaker and back to the series field of the machine, making a total of seven cables, including the neutral. Either of these methods affords the best possible protection to the generator, but in (*a*) the circuit-breaker is not a part of the switchboard, and in (*b*) the number of cables is a serious objection.

(2) The breakers can be placed in the mains beyond the series fields, in which case two arrangements of this apparatus are possible: (*c*) a four-pole breaker with a pole in each main and equalizer circuit, or (*d*) a three-pole breaker with a pole in each main and equalizer from one side of the generator, and the remaining pole in the neutral circuit. Either of these cases requires five cables from the generator to the switchboard, but both are open to the objection that they do not afford absolute protection to the generator, as the equalizing current does uot pass through the main pole of the breaker.

The mounting of ammeter shunts is another source of complication in connection with three-wire generator panels. Two ammeters are required for each generator, and in order that these indicate the full current in each side of the system, they must be connected in circuit between the armature and equalizer connection. In cases (*a*), (*c*), and (*d*) this means that the shunts have to be mounted on the generator frame, and special leads provided for connecting to the ammeters on the switchboard.

In addition to the wiring made necessary by the above connections, cables must be run from the generator to the balance coils, when the latter are separate from the generator, the number of these cables depending on the type of phase connection used.

When this equipment is contrasted with that necessary in the case of the two-wire generator with balancer set, where a single-pole circuit-breaker only is required in the generator circuit, where the ammeters are connected, one in the generator circuit and one in the neutral from the balancer, and the connections of the balancer to the main circuit are of small capacity, and three in number, the simplicity of the latter arrangement, and the ease with which trouble can be located and remedied, is apparent.

Any two-wire system can be converted most readily into a three-wire system by the simple addition of a balancer set and control panel, consisting of starter, field regulator, and switches for connecting to the existing mains. The system can be extended at any time by the further addition of two-wire generators or balancer sets as may be required, without any complication other than would be met with in extending a two-wire system.

To install a three-wire generator on an existing two-wire system entails the rearrangement of the series field of the two-wire machine, and the putting in of two equalizers from the latter, before the two machines can be operated in parallel. Besides this there will be necessary a redesign of the switchboard and its connections to the generator. This must be repeated for each machine on the system.

Balancers can be located at any distance from the main generator, and thus be brought close to the circuits which they are to supply; and can be arranged to compensate for a drop in voltage on the feeders to which they are connected. The three-wire generator must be located in the station, and its lines extended to the point of service.

The three-wire system with balancer makes use of a standard two-wire generator, and the machines comprising the balancer are standard apparatus. The three-wire generator is special throughout. This stands in the way of quick delivery, and is always a detriment when repairs are to be made.

The three-wire generator by reason of its divided field circuit and double equalizer connections is open to the objection that adjacent series fields and the equalizers have the full potential of the generator across them, and that extra care must be taken to avoid short-circuits between these parts.

It is desirable that the series fields of generators operating on any system be thrown in circuit before the machine is paralleled, in order to avoid voltage disturbances on the system, and to correct any reversal of polarity that may have occurred. This is impossible where the circuit-breakers are connected beyond the series fields, as described under circut-breaker connections, as the incoming machine, before its voltage is built up, would act as a dead short-circuit to the rest of the machines on the line. This practice may be followed, however, where the circuit-breakers are connected between the armature and series fields, by leaving the breakers open until the voltage of the incoming machine is built up to that of the line.

Examination for Radio Inspector.

The United States Civil Service Commission has announced an open competitive examination for radio subinspector to be held on August 20 at the usual places. Vacancies are to be filled at $6.00 per day and $4.00 per day in the Navy Yard, New York City.

The examination will cover theoretical and practical questions in the construction, use and adjustment of radio apparatus, and credit will also be given for technical training and experience in this line.

Upon the same date an examination will be held for radio electrician to fill vacancies in the New York Navy Yard and elsewhere as they may occur, at $4.48 per day. This examination will also cover practical questions on the construction, use and adjustment of radio apparatus and auxiliaries. An equal credit will be given for practical experience.

Applicants should secure Form 1,312 from the United States Civil Service Commission, Washington, D. C.

In 1912 Missouri produced 440,725 pounds of copper, valued at $72,719.

College Instructors Work in Shops.

Believing firmly in a closer co-operation between industrial and educational institutions, to the advantage of both, 28 college instructors representing the electrical engineering departments of 26 colleges are spending their vacations working side by side with the skilled mechanics and engineers of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa.

By taking this course, the instructors are aiming to accomplish a four-fold object: to obtain a first-hand working knowledge of the methods of practical engineering; to secure the opinions of successful engineers and manufacturers on the qualifications of men needed in industrial work, so that they may be taught accordingly, and thereby be properly qualified for success in their chosen branches; an exchange of teaching ideas among themselves; and a study of the industries of the Pittsburgh district.

College instructors are usually lacking in practical knowledge of works management and efficiency methods and it is hoped by this course to gain such a knowledge from close contact with such work and the men who direct it.

At the evening meetings, lectures are given by engineers, works managers, foremen, and also by educators from their own number and the educational institutions of the Pittsburgh district.

In such meetings and by close association with one another for a period of several weeks, ideas are obtained and fully developed that prove of immense advantage in furthering their work in teaching electrical engineering.

Prof. George B. Thomas, of Colorado College, has charge of the course and is looking after the details, in addition to working himself. A complete schedule has been worked out covering the lectures and the industrial plants, one of which is visited each week.

Group of College Instructors Who Are Working in Westinghouse Shops.

The instructors are employed on the regular shop payroll and conform to shop hours and regulations, receiving therefor a compensation of 22 cents per hour, or an average of $55 per month; the regular rate for second-year apprentices.

The Westinghouse Electric & Manufacturing Company is a warm supporter of this movement of co-operation between the industrial and educational institutions, and has delegated its highest officials and engineers to meet with the instructors and explain to them the work of the various departments of the big electric works, each phase being explained by an expert in his line.

At the close of working hours in the evening, these student workmen, without stopping for dinner, get a lunch of sandwiches and coffee and proceed on a trip of inspection through the works, guided by shop foremen and superintendents, ending in a meeting for discussion of the points covered on the trip.

The following is a list of men in attendance and the colleges from which they come: F. C. Bolton, Texas Agricultural and Mechanical College; O. L. Britt, Oklahoma Agricultural and Mechanical College; W. Buhl, Pittsburgh High School; J. B. Coleman, University of South Carolina; S. P. Coale, Bliss Electrical School; J. A. Correll, University of Texas; B. C. Dennison, Carnegie Institute of Technology; J. R. Duncan, Kentucky State College; J. R. Eldred, Rhode Island State College; D. D. Ewing, Purdue University; J. J. Gilbert, Armour Institute of Technology; W. D. Goodwin, Bliss Electrical School; W. T. Haines, Montana State College; H. H. Hoy, South Dakota State College; E. W. Kellogg, University of Missouri; L. R. Leonard, University of Colorado; W. L. Lodge, Michigan Agricultural College; E. B. Paine, University of Illinois; A. R. Perrine, Mississippi Agricultural and Mechanical College; V. C. Prichett, North Carolina Agricultural and Mechanical College; F. J. Rankin, Colorado Agricultural College; F. A. Robbins, Iowa State College; J. B. Sheadel, University of Pennsylvania; W. B. Stelzner, University of Arkansas; J. F. Stevens, University of North Dakota; G. B. Thomas, Colorado College; O. B. Wooten, Texas Agricultural and Mechanical College; C. C. Van Nuys, South Dakota School of Mines.

Illuminating Engineering Convention Papers.

The time selected for the annual convention of the Illuminating Engineering Society, in Pittsburgh, Pa., September 22 to 26, has proved to be particularly fitting, inasmuch as at that time the city will be celebrating the 125th anniversary of Allegheny County, and will be decorated accordingly. This means that the visitors will be able to see Pittsburgh in holiday attire and witness many special illuminating features.

The papers committee reports a program of papers, the subject and authors of which are sufficient to attract the favorable attention of those interested in illumination. The committee announces the following papers, although the program is not yet complete: "The Use of the Photo-Electrical Cell in Photometry," by T. R. Richtmeyer, of Cornell University; "Characteristics of Inclosing Glassware," by V. R. Lansingh; "The Quartz Mercury-Vapor Lamp and Its Applications," by W. A. D. Evans, of the Cooper Hewitt Electric Company; "The Pentane Lamp as a Working Standard," by E. C. Crittenden and A. H. Taylor, of the Bureau of Standards; "The Neon Vacuum-Tube Lamp," by Georges Claude, of Boulogne, France; "Show-Window Illumination," by H. B. Wheeler.

In addition, Roscoe Scott, of the National Quality Lamp Division of the General Electric Company, will deliver a lecture on "The Evolution of Illuminants."

The Philadelphia Section intends to present to the presiding officer of the convention a historical gavel. Robert Ely is chairman of the Gavel Committee.

Memorial for A. N. Brady.

Following the news of the death of Anthony N. Brady, directors of the Edison Electric Illuminating Company and the Kings County Electric Light and Power Company met on the morning of July 24, and expressions of regret were framed. Mr. Brady was president of both companies.

A committee composed of William Berri, Frank Bailey, Bernard Gallagher and Thomas E. Murray was selected to prepare a memorial and suitable resolutions to be forwarded to Mr. Brady's family.

AN INTERESTING SIDE LIGHT ON THE COST OF MEMBERSHIP IN THE SOCIETY FOR ELECTRICAL DEVELOPMENT.

By W. E. Robertson.

The cost of participation on the part of jobbers and contractors in the work of the Society for Electrical Development has been fixed at one-twentieth of one per cent on the gross sales. To some one-twentieth of one per cent on sales seems to be a substantial tax on the cost of doing business, and many hesitate to commit themselves to a contribution of this amount.

A correct analysis of the purpose of this contribution will take it out of the cost-of-doing-business column and place it properly where it belongs; that is, in the column to create a larger market. Few, if any, contractors or jobbers have such a column in their ledgers, but it is high time such a column be provided, as it is of great importance to all that an increased market be provided, in which each may participate.

An appropriation of 1/300 to 1/400 of one per cent of the expense account of jobbers and contractors is the equivalent to one-twentieth of one per cent on the sales, and viewed from this angle the cost of co-operation in creating an increased market is infinitesimal.

The average cost of doing business over a period of years on the part of both contractors and jobbers is from 15 to 20 per cent of the sales and heretofore the entire 15 to 20 per cent has been spent in securing business on a competitive basis, and nothing has been spent in increasing the total demand.

It has never been possible in the history of civilization to secure co-operative effort on the part of an entire industry, the reason being the very old one that human nature is so distrustful of the future as to make it exceedingly difficult to get men as a class to part with a present tangible dollar for the purpose of securing, and in fact positively insuring, many future dollars.

The impossibility heretofore to overcome this stupidity on the part of men should not feaze us, as an increasing confidence in one's fellowmen, added to an ever increasing intelligence, has prepared our industry to do that which has never before been done. No industry by its repeated accomplishment of the so-called scientifically impossible, has so stirred the imagination of those connected with it as has the electrical industry, and one has but to mention the incandescent lamp, the telephone, the X-ray, the wireless telegraph, the aeroplane and submarine to establish the truth of this statement.

If, therefore, our industry as a whole owes its existence to the demonstration that that which was formerly impossible is now possible, isn't it logical to believe that the imagination of the jobbers and contractors has been sufficiently aroused, and their faith in the integrity of the administration details of the society sufficiently strong, to warrant the belief that 1/300 to 1/400 of the cost of doing business will be set aside for the purpose of increasing the sum of the opportunity to do business, leaving the other 299/300 or 399/400 of the cost to be used in its present and former channels?

Doesn't the history of the industry, and the smallness of the stake to participate, warrant the risk?

I am of the belief that the subscriptions will be forthcoming when the logic of participation and the infinitesimal cost of participation is thoroughly understood.

Electrically Propelled Naval Collier Completed.

The United States Collier *Jupiter* was recently completed at the Mare Island Navy Yard near San Francisco. This vessel is of particular interest because she is the largest ship as yet equipped with turbo-electric drive. The central power unit is a nine-stage horizontal Curtis steam turbine directly connected to a three-phase, 33-cycle, 5,450-kilowatt generator, both machines running at about 2,000 revolutions per minute. The generator supplies 2,300-volt current to two induction motors, one of which is directly connected to each of the two propellor shafts and drives them at a speed of about 110 revolutions per minute, giving the vessel a rated speed of 14 knots per hour. At the switchboard, from which the maneuvering is controlled through the electric machines, there are provided two oil switches for each motor, thus permitting them to be operated and reversed independently. Remote control is provided from this point for water-cooled starting and speed-regulating rheostats for each motor. The vessel has a length of 540 feet and a beam width of 65 feet.

Memorials to Lord Kelvin.

A statue of Lord Kelvin was unveiled on June 19 in Belfast, Ireland, by Joseph Larmor, the distinguished mathematician. The funds for this memorial were raised by subscription among the citizens of Belfast, where Kelvin was born and was a student in Queen's University. The statue represents Lord Kelvin standing erect with a gyroscope in one hand, and is the work of Albert Bruce-Joy.

On July 15, the Kelvin memorial window in Westminster Abbey, London, was formally dedicated. A description of this window will be found in the issue of April 19, page 794.

Lightning Protection for Aerial Lines.

The question whether a guard wire should be provided above high-tension electric areal lines has been much disputed. In the *Elektrotechnische Zeitschrift*, R. Fertsch, of Worms, mentions an observation which indirectly seems to support the advisability of this practice. A three-phase aerial line, 20 kilometers in length, had been erected, but had not yet been joined to the terminals on the tower from which the power distribution was to take place there being gaps, 8 centimeters in width, left. The tower was supplied with lightning protection of the horn type and with conductors. The three wires of the electric transmission were strung on iron masts, the supports forming corners of an equilateral triangle, such that two wires were in the same plane, and a third wire was about 80 centimeters higher up. On the day referred to the weather was very sultry, but it did not come to a thunderstorm. Yet strong discharges were seen to pass across the gap from the end of the line to the tower terminal at regular intervals of 5 seconds. These discharges were confined to the top wire, however, which thus seemed to serve as a lightning guard for the others below.

Canadian Representatives for N. E. L. A. Committees.

On July 22 the Administration Committee of the Canadian Electrical Association met in the offices of the Toronto Electric Light Company, Limited, in Toronto, Ont., to appoint Canadian representatives for various standing committees of the National Electric Light Association.

The following representatives were appointed: A. A. Dion, Ottawa, on the Research Committee; W. J. Angus, Hamilton, Power Transmission Committee; W. H. McIntyre, Ottawa, Commercial Section Committee; W. H. Goring, Hamilton, Solicitors Handbook Committee; G. W. Magalhaes, Toronto, Meter Committee; Wills Maclachlan, Toronto, Committee on Street Lighting.

Big Panama Switchboard on Exhibition at Schenectady.

The General Electric Company is rapidly completing the switchboard for the control of the locks at the Panama Canal, and is shipping the parts as they are finished. The sections of the switchboard that have been completed are being exhibited to the staff and employees at Schenectady. Last week a number of prominent electrical men visited Schenectady for an inspection of this switchboard.

PROFESSOR BELL AND DOM PEDRO.

By Walter P. Phillips.

Prof. Alexander Graham Bell made a very pleasant talk in Boston, a while ago, in which he related his experience with His Majesty Dom Pedro, Emperor of Brazil, at the Contennial Exposition in Philadelphia in 1876.

At that time, it appears from Prof. Bell's narrative, he was conducting a school of vocal physiology in Boston and when his telephone was first shown in Philadelphia, it was with great difficulty that he was induced to accede to the demands for his presence. But two of his coadjutors, William Hubbard and a Mr. Saunders, both of whom were financially interested in Professor Bell's invention, were on the ground and insisted that he should leave what he conceived to be much more important matters than a visit to Philadelphia and come on and help them out in their endeavors to have some one take a look at what they had to show. Very reluctantly Professor Bell agreed to waste a Sunday on condition that he might so arrange his itinerary that he would be back in Boston Monday morning. "Why, goodness alive!" he remonstrated, "my examinations are on. How can be away from Boston?" But grumbling as he went, he reached Philadelphia in due course, his heart, however, with the pupils he had left behind—bright young men and women who had fitted themselIves, under his tuition, to go forth and teach articulation to those hitherto deemed to be dumb. Miss Hubbard, who had married the Professor, was a mute and every movement toward the relief of those thought to be incapable of speech interested him much more than any commercial phase of the telephone development.

Professor Bell was not known in Philadelphia and he was treated with scant courtesy. He chased the celebrities, who were the judges, up hill and down dale until he was worn out. Even the judges, before they ever reached the telephone exhibit, felt like crying out, with Helena "Never so weary, never so in woe, I can no farther crawl, no farther go." So the Professor, much more disgusted than tired and yet weary enough to drop in his tracks, told himself "No more of this, if you please. Boston, my Boston, is good enough for me." In another ten seconds he would have been on his way to reach the Massachusetts coast, with as little delay as possible, but at this juncture up jumped His Majesty Dom Pedro, one of the tired-out judges and, suddenly recognizing the Boston teacher, sang out heartily, "Mr. Bell, how are the deaf mutes in Boston?"

Professor Bell told His Majesty that they were all very well and casually observed that the next exhibit on the list was his own. "Come along," shouted the Emperor to his associates, and taking Professor Bell's arm they sallied forth followed by the lame and the weary. As Profgessor Bell puts it in his recent talk, "Where an Emperor led the way the other judges followed. And the telephone exhibit was saved."

Thanks to Dom Pedro, the telephone which had been hailed as a wonderful thing by all scientific folk, but which had been viewed askance by the people, got itself on view in Philadelphia and made its importance felt at a most opportune time. The Emperor became interested at once, and insisted on seeing what it could do; and when he heard Professor Bell reciting the familiar "To be or not to be," he cried out, "My God; it speaks."

The next dignitary to try it was the late Lord Kelvin, at that time Sir William Thomson—another of the judges—and his amazement was apparent, also. But in spite of his exceptional and unexpected triumph, nothing could stop Profesor Bell from proceeding to Boston with all haste. He started that very night.

All sorts of claims as to who had the first telephone line constructed out of doors, was settled by Professor Bell on the recent occasion. He said it was constructed on April 3, 1877. It simply connected the office of Charles Williams, Jr., with his home.

Professor Bell attributes the success of his telephone to two things: First, the interest manifested in it in Philadelphia by Dom Pedro, at a critical moment. "If I had not had that exhibition there," he said, "it is very doubtful what the condition of the telephone would be today." The other really effective episode in the early career of the telephone as viewed by the Professor, was the sending of a dispatch by a Boston Globe correspondent at Salem, Mass., to his paper in Boston on February 23, 1877. "That, more than anything else," said Professor Bell, "woke up the press of the world to the advantages of the telephone. That article in the *Globe* was copied all over the world and had a great influence on public opinion."

Professor Bell spoke of exhibitions of his invention at Branford, Ontario, Boston, Salem, Washington and Providence, but singularly enough he made no mention of an exhibition he gave in New York in 1876, when he came down from his summer vacation at Branford. This was given at the Hotel St. Denis and an unsuccessful attempt was made to work with Brooklyn. A young man named Fred Gower was at the Brooklyn end of the wire, but he was never heard from during the entire evening. Many telegraph men were present, including Gen. Thomas T. Eckert, Alfred S. Brown, Thomas Dolan, Thomas G. Kennedy, Walter P. Phillips and others and they were a very skeptical lot. Some one told the story of the Gloucester sailor who came home and told his neighbors of the wonders of the deep and the mystery of foreign lands and when the sailor was not looking they winked at each other. In a few days a traveling astronomer came and lectured on the grandeur of the heavens and his hearers winked at each other and the most active winker was the sailor. This tale pleased Professor Bell very much and he laughingly assured his audience, as he was shutting up shop, that his invention was all right. A leaky cable across the East River, or something that would be easily remedied on another occasion, had operated fatally to our having heard the voice of his charming young friend Gower, but another time there would be no winking at the sailor's story or even at the astronomer's.

Fred Gower was the able son of a widow who was a principal in one of the Providence schools and she prepared her son for a newspaper career by giving him a thorough common-school education and then putting him to work, with a view to seasoning him, as a messenger in the service of the Western Union Telegraph Company. He was a success and seasoned so rapidly that he soon graduated. The next that was heard of him he was a reporter on a bright morning paper, in Providence, since turned to dust, and among his assignments was one to follow up the exhibitions of Professor Bell's telephone. That was early in 1877, and on one occasion the Professor came in search of a wire that did not run very closely to the other lines, his idea being that he would get more perfect results if the induction could be avoided and something hit upon to overcome it. The late Preston J. Hurlburt of the Western Union Telegraph office found a wire that ran, by itself, to a suburb a dozen miles from Providence called Pascoag. A conveyance was obtained and Messrs. Bell and Gower accompanied by Oliver Williams, a telegraph-line constructor, proceeded to Pascoag with the instruments, where they set them up and called Providence. Mr. Hurlburt engineered things at that end of the line, assisted by Albert C. White and Prof. John Pierce of Brown University. The results obtained were perfect and thus encouraged Professor Bell returned to Boston, coming back in April with his apparatus reinforced with a shunt, or some similar device designed to dispose of induction. Communication was freely had with Boston and a well known bugler played his instrument there and it was dstinctly heard in Music Hall, in Providence, where Professor Bell had just finished a delightful lecture before one of the most intelligent and refined audiences that had ever listened to a

scientific discourse in that city. By that time Professor Bell had left the New York cousins of the Gloucester manipulators of their eyelids far behind and soon the sailors had accepted the telephone as a fact, whatever opinions they might hold on the subject of astronomy.

Not long after that Gower went abroad and introduced in France what was known as the Gower-Bell telephone. It varied but little from the Bell, its principal point of difference being in the way in which the signal was given. Gower made a great fortune and became a social lion in Paris. Here, courted on all sides, he remained steadfast to his preference for a beautiful cousin—at one or two removes—Lillian Norton of Maine, and they were ultimately married with great *eclat*. His widow is known the world over as Madame Nordica, one of the most wonderful artists and singers of all time. Gower's mind turned naturally to scientic achievements and he became infatuated with flying. One day he went up in his balloon, was seen to float through the air in the direction of the English Channel and that was all. The manner of his death is one of the great uncertainties, but by most of his friends it is assumed that his bones rest at the bottom of that turbulent channel.

Dom Pedro's activity in behalf of Professor Bell was characteristic of him. On the day when he was being shown through the Western Union Telegraph Company's operating room, chairs were brought for him and his suite. As this was being done he was intensely absorbed by the explanation that the late Thomas G. Kennedy was making as to how the numberless wires were brought to what is technically known as a switchboard and how, when they were centered there, they were manipulated. The Emperor was all attention and entirely oblivious to what was going on near him. "You see, your Majesty," said Kennedy, "that when this plug is in that particular little pocket, Washington is connected through to Boston, but if I change those two plugs thus, and Boston makes a corresponding change on his board, Philadelphia is connected with North Sydney, where messages are relayed and go over the cables to Europe."

Just then Dom Pedro turned and saw a row of chairs which had been brought for his staff and himself and seizing Kennedy by the shoulders he said, "Sit down, my dear sir. You must be tired after your exhaustive explanation of these many mysteries," and gently pushed Kennedy into a very large chair that had been intended for Dom Pedro's personal use and which had been brought up from the private office of President Norvin Green. Then taking a less elaborate chair which was tendered by one of his aides, he seated himself by Kennedy's side and for a quarter of an hour, or twenty minutes, perhaps, they chatted merrily together. When they parted Dom Pedro took Kennedy by the hand, grasped it firmly and said, "I thank you very much, Tom."

That was a great day in telegraph circles and six years later over in a building across Day Street, in which the American Rapid Telegraph Company was housed, there was a struggling opposition press association, whose manager had been invited to the Dom Pedro reception over in the Western Union operating room when he was with the Associated Press, whose offices were in the same building. So impressed was he by the quick perception and the jovial, democratic spirit that characterized the visitor from Brazil that he never forgot him, and he often talked about the Emperor to his comrades in the Associated Press and later to his associates in his own modest organization. One day as he came hurriedly into his office from luncheon he was met by a subordinate, a recent acquisition, who began his question thus, "What shall we do with all those rusty old perforators belonging to the Rapid, in that room of ours that I want for—";

"Oh, I guess you had better send them to Dom Pedro," replied the manager, as he plunged into his own little den. Some months later, the general manager of the Rapid Telegraph Company was surprised to receive a letter from a government official in Rio Janerio saying that a large amount of machinery, evidently the property of the American Rapid Telegraph Company, had been received a few weeks before, on which the freight charges were $152.61, and as the instruments had evidently been sent to Brazil by accident, the writer's Government had refrained from paying the bill of the steamship company as it seemed incumbent on the Brazilian Government to reship the machinery that had inadvertently been sent to their beloved Emperor. The telegraph company finally got their rusty, antiquated and useless perforators back into their own possession, at an expense of some $350. Up to the time when Jay Gould seized the American Rapid property and thereby became involved in what is known in telegraph history as "the two-million-dollar suit," its venerable though extremely active general manager, the late Fred H. May, went hunting at intervals for the meddler who shipped those perforators to Dom Pedro. But strange to relate no one had the faintest suspicion who the culprit was.

Transcontinental Telephony.

New York City and Denver have been connected for long-distance telephone communication for some time. Plans have now been completed for the stringing of four heavy copper wires from Denver to San Francisco, which with the phantom circuit established on them will give three complete telephone circuits between these western cities and put into actual realization telephone service across the continent.

Wireless to Asia.

Direct wireless communication between America and Asia is now an accomplished fact, the United States Army Signal Corps Station at Nome, Alaska, having been in nightly communication with the Russian station at Anadyr, Siberia, 500 miles west of Nome.

The Russian Government operates a chain of four stations between Anadyr and Vladivostok, and for the last six months the Signal Corps operators have been trying to establish communication with the Russian stations.

Government officials said that a diplomatic agreement would be necessary before Nome station could co-operate with Russia for the commercial use of the government station in Alaska. While it is expected that a satisfactory agreement will be reached, it is pointed out that the problem is a delicate one, involving the question of the United States granting to Russia a concession placing that government in the field as a competitor with American companies.

Interborough Traffic Gains.

The Interborough Rapid Transit Company carried 27,000,000 more passengers in the year ending June 30, 1913, than in the year preceding. As a result, its gross earnings, as shown in a preliminary report for the year, were larger by $851,000 than for the previous year. Operating expenses increased only $213,000, so that the company's net revenue for the year carried a gain of $1,038,000.

The surplus earned for the stock was almost exactly the same last year and this. For 1913 the company had a balance equivalent to 18.7 per cent on its $35,000,000 of stock. The increase in net earnings for this year was about offset by an extra dividend, of 15 per cent, amounting to $900,000, which was paid into last year's other income out of the earnings of the Rapid Transit Subway Construction Company. In 1912 the surplus amounted to 18.6 per cent on the stock. The company paid a regular dividend of 10 per cent in each year, with 5 per cent extra in 1912 and 2 per cent extra in 1913.

Canadian Electrification.

It has been announced that the Canadian Pacific Railway Company will electrify a portion of its transcontinental line crossing the Rocky Mountains. This innovation will be introduced between Rossland and Castlegar. If the results obtained warrant it, the electrification of many mountain branch lines will follow. Direct current at 2,400 volts will be used, with overhead trolley.

BOOK REVIEWS.

"Stabilität, Labilität and Pendelungen in der Elecktrotechnik." By Hans Busch. Leipzig: S. Hirzel. Paper or cloth, 246 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company in paper for $1.50 and in cloth for $1.75.

The appearance of Dr. Busch's book is one of the best proofs of the rapid progress which electrical engineering has made in the last few years. While the student of a decade ago, during his college course, hardly heard of the phenomena of instability, this volume of nearly 250 pages is devoted to the subject of unstable electrical conditions exclusively, following closely the publication of Humburg's book: "Das Pendeln bei Gleichstrommotoren mit Wendepolen," which appeared only a few months ago and dealt only with the phenomena of instability in interpole motors.

The many cases of electrical instability which have become of interest and often a source of great annoyance to the electrical engineer are usually found discussed and more or less satisfactorily explained, scattered through various texts and treatises. It indicates always a great step in advance when such occasional observations are treated from a single point of view and a general principle is laid down which may be applied to the different particular cases. This Dr. Busch has done successfully, though he needs the use of considerable mathematics before he is able to treat satisfactorily the most important case of electrical instability, namely, that of interpole motors.

The first few pages appear simple enough; the criterion of stability simply states that at the terminals of that part of the electric circuit, in which energy is used up—this part we will call the motor (Verbraucher) circuit—the potential difference must increase with the current more rapidly than the applied electromotive force; or, that in the electromotive force-current diagram the motor characteristic must have a steeper slope than the generator characteristic. This criterion is applied by the author to the arc lamp and the Nernst lamp and the necessity for the introduction of ballast resistances is clearly shown. The reasons why series generators cannot be excited with a large external resistance or below a critical speed; why they should not be used for charging a storage battery; and why an equalizer is needed when two such generators are used in parallel; all these easily follow from the principle laid down. It is also applied with success to the conditions in divided circuits.

In all these earlier considerations it has been assumed that the characteristic is a single-valued function of the current. Since such is never exactly the case, the author, following Simon, introduces the "dynamic characteristic" along which, at a given point of the curve the variations of the potential difference actually occur. The dynamic characteristics of generator and motor are both differential questions, including the time rate of variation of the current. From their equations the more general differential equation for the variation from equilibrium is derived and finally the condition is introduced that for stable equilibrium these variations shall vanish in time. In order to solve such a problem the author makes use of the mathematical theory of small oscillations. In fact, the whole book may be characterized as an application of this theory to electrical phenomena. The first chapter closes with an application of this method to a shunt-wound generator.

In the second chapter the author discusses the problem of rotating masses, at first purely from a mechanical point of view, and arrives at a criterion of stability, exactly corresponding to the electrical criterion, by simply substituting the torque-angular speed diagram for that of electromotive-force-current. Though at first glance this is a purely mechanical problem, we have all learned that it plays an important role in all machines containing rotating armatures. Applications to the single-phase and two-phase motor are found in this chapter.

The third chapter deals with the mechanical-electrical stability, that is, with the modification of the conditions of electrical equilibrium introduced by the torque of rotating armatures. The author shows clearly the necessity of taking the mechanical factors into account in all cases where a generator furnishes the power for a motor or where a motor drives a generator. In these cases the instability of the system shows itself in "hunting," that is, in the periodic variation, sometimes with large amplitudes, of the angular speed, as well as of the current. In a most interesting discussion it is proved that we may reduce the question of mechanical-electrical stability to one of electrical stability alone and that the resulting differential equation corresponds in its form to the well known equation for the discharge of a condenser. The direct-current generator may be considered from this point of view as a condenser, if in the unstable condition, it is able, after having received a sufficiently large electrical impulse, to produce pure electrical vibrations which are usually strongly damped. Experimental data are given in support of the theory.

In the last, the fourth chapter, various applications of the preceding theory are given. Among them may be mentioned the cause and remedy of hunting of a series motor if driven by a series generator, Bernstein's and Thury's systems of power transmission and the various causes and remedies for the instability of motors with interpoles. On account of the great practical importance of the subjects discussed in the last two chapters, about two-thirds of the whole book is devoted to them. Some of the questions raised and the method of solution used will greatly interest not alone the practical engineer, but also the physicist. This is especially true of the method described for the production of sustained electrical vibrations of very long period.

Dr. Busch is a member of the faculty of the Institute for Applied Electricity at the university of Goettingen, where under the leadership of Professor Simon so much is being done for the development of the theoretical side of electrical engineering. The book may be commended highly. The style is clear and the mathematics, while somewhat advanced, not very difficult.

K. E. Guthe.

"An Elementary Treatise on Calculus." By William S. Franklin, Barry MacNutt and Rollin L. Charles. Published by the authors, South Bethlehem, Pa. Cloth, 294 pages (5½x8 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

In this work the authors have shown their sympathy with the student of calculus by presenting its essential topics in an admirable and commendable manner. They have abandoned the orthodox setting and with educational discretion have presented their material in such a form that it is a living and responsive reality, vitally interesting from beginning to end and devoid of the impedimenta which so often prevent an appreciation and skill in the application of its principles. The book is a notable, positive contribution, marking a distinct advance along the lines set down by the distinguished pioneer, Prof. John Perry, and therefore it should receive a hearty welcome from those individuals whose minds are unfettered from the traditional sequence of subject matter and free from the pernicious prejudice which is possessed by some non-mathematicians who are accustomed to teach applied mathematics under the disguise of another name. The authors have displayed pedagogic wisdom by developing principles through the study of concrete problems and from these leading to generalities. They recognize that calculus has been of inestimable value in the development of

the theory of the larger divisions of applied mathematics and so they have sought their problem work from the rich domains which calculus has fostered. The book is comprehensive and yet one marvels at its few pages.

Chapter I is "A General Survey of Differential and Integral Calculus." It presents the student with a long-range view of the scope of calculus. New ideas are developed with interesting applications and at the same time the thrills and inspiration of acquaintance with the majesty of the symbolism is as keenly felt as under any masterhand. The real significance of integration is taught logically as a simultaneous reversible process of differentiation. An intelligent exposition is given to the physical meaning of a constant wherever it enters a problem, either as a proportionality factor or as an accretion arising in the process of integration. The transition from topic to topic is natural and the usual difficulties of the subject are anticipated and disposed with lucidity. With a good idea of the meaning of both the derivative and the integral which is acquired in the introductory chapter, the student is acquainted in Chapter II with the "Formulas for Differentiation and Integration." In this chapter the usual set of standard forms are not worked out fully but some of the work is wisely set in the form of exercises and only a sufficient amount of development work is shown to make the student appreciate the validity, use and need of the rules and forms of differentiation and integration which are given in the tables of the appendix. The presentation of differentiation both explicitly and implicitly is the happiest method whereby one may lead to the chapter on "Partial Differentiation and Integration." A very carefully selected list of applications and problems make up the chapters on "Integration" and on "Miscellaneous Applications." The chapters on "Expansions in Series. Use of Complex Quantity," "Some Ordinary Differential Equations," are brief, concise and to the point. The chapters on "The Differential Equation of Wave Motion," and "Vector Analysis" are notably well written and supply a long felt want.

The value of Chapters I and II would have been enhanced if an appendix were given, stating the more fundamental theorems on "limits" and "the order of magnitude of infinitesimals," because they are not "obvious" when used as authorities for various statements of proof. A book of this type should have given a very much more extensive application of graphic methods in differentiation and integration not only in recognition of a multiple sense appeal but also on account of the importance and attention given to it by men in vocational life. It is regretted that Chapter VIII was not concluded with a worked problem showing the calculations for the values of the coefficients to an experimental curve, involving Fourier's series. The authors have evidently overlooked the fact that a summary at the end of each chapter would have been of inestimable value to the student, while a more judicious system of numbering problems and the omission of their accompanying answers would have proven more satisfactory from the standpoint of a majority of progressive teachers. Appendix C has a questionable choice of references which seems more applicable to the mathematical physicist than to the engineer.

A careful study of the book leads one to agree almost unqualifiedly with the authors that, "The absolute requisites for the study of this work are: a knowledge of elementary algebra to the binomial theorem (according to the usual arrangement), plane and solid geometry, trigonometry, and the most simple parts of the usual applications of algebra to geometry."

E. H. Koch, Jr.

"Engineering Valuation of Public Utilities and Factories." By Horatio A. Foster. New York: D. Van Nostrand Company. Cloth, 329 pages (6x9 inches), no illustrations. Supplied by the Electrical Review Publishing Company for $3.00.

One of the vital economic questions of the day is that of the relation between the public and the public-service corporations. The "public-be-damned" spirit of a decade ago is being supplanted rapidly by a general and willing recognition on the part of the corporations that the public has rights that must be reckoned with; while the former indifference of the people at large is giving way to a feeling of lively interest. At the root of all this unrest lies the question of value: not mere physical value, but value in that broader sense which takes into account, with fairness and equity, all the circumstances surrounding each case. It is with such value that the last book of the late Horatio A. Foster deals.

Electrical engineers are generally familiar with Mr. Foster's ability as a compiler of engineering data, his "Electrical Engineers' Pocket Book" having established a high standard in that field. Mr. Foster's present work is of a wholly different nature. Instead of dealing principally with concrete facts and figures, it discusses the underlying principles on which value rests, and gives a most comprehensive review of the thought and opinion on that subject. To those who knew Mr. Foster only through his "Engineers' Pocket Book," this work will reveal another distinct phase of his versatility.

The most valuable portion of the work, in the reviewer's opinion, is found in the first few chapters, which discuss value, both tangible and intangible, and the various factors which enter into its determination. Mr. Foster has not only given his own views, but has, with characteristic fairness, quoted freely from other authorities, so as to enable the reader to view the problem from all its different angles. Not the least important part of this portion of the work is the citations and quotations from the principal court decisions which mark the recent progress in this line.

This more general presentation of the subject is followed by instructions to the engineer in making valuations, and in this again Mr. Foster takes pains to show what the attitude of the courts has been in the various cases in which values of public-utility properties have been involved. A very large number of forms on which to collect the data are shown, which will certainly be useful, at least in a suggestive way, to those on whom the duty of making such appraisements falls.

The last half of the book is devoted to a detailed discussion of such matters as good will, going value, depreciation, amortization, franchises, capitalization and the control of public utilities. The last 60 or 70 pages give an analysis of several of the most important court decisions on famous public-utility cases. On the whole the work is a valuable addition to engineering literature concerning a subject that must continue in increasing measure to attract the attention of engineers.

Kempster B. Miller.

"La Télégraphie et la Téléphonie Simultanées et la Téléphonie Multiple." By K. Berger. Translated by P. Le Normand. Paris: Gauthier-Villars. Paper, 135 pages (6¼x10 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

The problems of simultaneous telegraphy and telephony and multiplex telephony have engaged the attention of many engineers and inventors. A number of different methods have been proposed as solutions of these problems, but comparatively few were found to meet all the requirements of commercial practice.

In the book under review, the author gives a descriptive discussion only of those methods which have been adopted in practice and found to give satisfactory results. The author does not attempt any theoretical discussion of the subject, but he describes fully the

actual operation of the various methods under discussion, and he gives a large number of diagrams which will prove very helpful to the reader. This book is evidently intended for the practical telephone and telegraph engineer, who will find it a valuable addition to the literature on the subject.

LOUIS COHEN.

"Electric Wiring and Lighting." By Charles E. Knox and George E. Shaad. Chicago; American School of Correspondence. Cloth, 182 pages (5½x8¼ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This is practically two books in one binding; Part I, by Mr. Knox, is devoted to electric wiring, while lighting is the subject of which Part II treats, Professor Shaad being the author of this section. There is no connection between the two parts further than the general relation existing between electrical construction and electric illumination. Part I consists of 88 pages and there are some 80 illustrations. The first nine pages are devoted to a rather general treatment of conduit wiring; the following five pages have to do with wiring in molding; then comes eight pages of discussion of knob-and-tube wiring, after which five pages are taken up with a treatment of the relative merits of two-wire and three-wire circuits; the calculation of direct-current conductors is given nearly four pages; to methods of planning wiring installations eight pages are devoted, and then methods of testing a completed installation are touched upon rather briefly. A 15-page treatment of the calculation of alternating-current circuits, in which the correct use of Mershon diagram is made very clear, is followed by a short chapter on wiring an office building; a brief discussion of outlet boxes, cutout panels and other electrical fittings precedes 20 pages devoted to outside wiring, which discussion covers both overhead and underground construction, and completes Part I.

Successful authorship of technical literature depends upon three things; namely, knowledge of the subject to be treated, facility in imparting one's ideas to another, and the ability to keep constantly in mind during the preparation of the copy the class of readers for which the book or article is intended. In Part I of the volume under consideration there seems to be considerable confusion as to the kind of reader the book is prepared for. There is a great deal that is bound to prove interesting and helpful to the engineer who draws up wiring specifications, and there is much apparently intended for the elementary student of electric wiring which will be of little or no interest to readers of the first class. In fact, there is enough of error and incomplete statement in this elementary material to rob it of much of its value to the beginner. For example, it is stated that conduit bushings form *insulated* orifices where the wires leave the conduits, that the *loss of voltage in the lamps will be doubled* if the lamps connected to a three-wire circuit are all thrown on one side of the circuit, etc. In short, Part I would seem to be worth the price of the book to the architect's engineer or men of his class, while for men not already fairly familiar with the elements of electric wiring its value is doubtful.

Part II, while it seems to contain very little matter that is new, seems very well adapted to the needs of the junior class in electrical engineering in the average engineering college, and to other readers of like attainments. There are one or two slight inaccuracies—such as the statement that the foot-candle is the amount of light falling on a surface one foot distant from a source of light of one candle-power—and it appears that the space devoted to certain types of lamps now little used is rather excessive; but on the whole the work is free from unwieldy theory and should be very useful to the reader who has had sufficient preliminary training.

"Growing Crops and Plants by Electricity." By E. C. Dudgeon. London: S. Rentell & Company, Limited. Cloth, 36 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for Twenty-Five Cents.

This volume explains what has been done on a practical scale and reviews in a clear and easily understood style the methods that have been used to force the growth of some vegetables and flowers through the means of atmospheric electricity and also through the use of electric lamps. There is also a generalization on the question as to how electricity affects the growth of plants. So far as the examples chosen by the author are concerned the use of electricity in one form or another appears to have a very beneficial effect.

New Electric Steel Works in England.

The new electric steel plant being established on the south side of the River Tyne, in England, by the Stobie Steel Company will be ready for operation in September, according to the *London Times Engineering Supplement.*

These works will at the outset comprise a melting shop 250 feet long by 60 feet wide and 50 feet high, with a lower bay 26 feet wide extending along one side of the main building. The installation includes one 15-ton electric steel furnace working on three-phase current, one 15-ton furnace operating on two-phase current, and one three-hundredweight ferro-alloy single-phase furnace. The furnaces, designed and erected by Victor Stobie, of Sheffield, will be worked from a steel platform measuring 80 feet by 28 feet and placed 8 feet from the floor level.

Three-phase current at 40 cycles, 6,000 volts, will be obtained from the Newcastle-on-Tyne Electrical Supply Company, and will be stepped down to about 65 volts. The supply cables will be duplicated from the Dunston power station, and continuity of supply will be further assured by a system of interconnections between the large current consumers in the Tyneside district. The furnaces will be tilted electrically for emptying, and the regulation of the supply of electricity to the furnaces will be automatic. The switch house is a two-story brick and reinforced concrete building 25 feet square, and it contains 11 panels of high-tension feed and switch gear. Two transformers, to supply a crane, some auxiliary motors, and lighting, are also placed in the swtich house.

A river jetty capable of accomodating seagoing vessels is directly connected to the private sidings, and an electric crane will handle the material from ship to wagon. The sidings will also be connected with the North-Eastern Railway system, and all shunting on the works siding will be performed by a 200-horsepower electric locomotive. Pig iron, scrap, and other heavy raw materials will be delivered to a siding which extends 60 feet down the center of the main building, and an electromagnet attached to the overhead crane will unload the trucks. A 20-ton weigh bridge for dealing with truck loads, and also ladles of molten metal, is placed under the crane track. A three-hundredweight electrically driven power hammer is provided for testing samples of the steel, while the main body is still molten in the furnace; this hammer will also be used for forging the various furnace steels. A blacksmith's shop and an installation of machine tools will complete the mechanical testing plant.

In the layout of these works provision has been made for convenient extensions. The output will consist of tool steels, automobile steels, high-tension steels, and other types of steels which are claimed to be superior when manufactured by the electric process. The annual capacity of the plant will at the outset vary from 20,000 to 30,000 tons, according to the type and quality of the steels.

New Electrical and Mechanical Appliances

Gould Starting, Lighting and Ignition Batteries for Gasoline-Driven Cars.

Two new types of storage batteries for the starting, lighting and ignition of gasoline-driven cars, as shown in the illustrations, are now being marketed by the Gould Storage Battery Company, New York, N. Y.

The active material in the positive plates of these batteries is very hard, dense and closely bound, so that a thin surface layer only is softened when the plate is developed for service. As the plate wears in continued service, more of the mass is gradually softening and the original capacity is thus maintained practically throughout the life of the plate, or until the active material is worn to a thin core.

Storage Battery for Lighting and Ignition.

Storage Battery for Starting, Lighting and Ignition.

The advantages of this hard paste composition are self-evident: resistance to wear, retention of capacity, resistance to dislodging of active material through overcharge, ability to withstand hard service conditions, and elimination of damage due to jarring and vibration.

The material in the negative plate is so chosen and proportioned as to automatically offset any tendency towards shrinkage during the life of the plate and the mass does not soften and slough out.

The group of cells, in hard-rubber jars, is inclosed in a strong hardwood box and the design of the terminals, hard and soft-rubber parts and pitch seal are such that leakage of acid and corrosion of the terminals are prevented. The terminals are out where they are of easy access, and the heavy connections are applied in a way that assures perfect electrical contact.

New Thordarson Toy Transformer.

There has long been a demand for a small low-priced transformer of guaranteed efficiency to operate small electric trains, motors and other toys. To meet this demand, the Thordarson Manufacturing Company, of 508 South Jefferson Street, Chicago, has recently placed upon the market a new toy transformer.

In this new transformer, designated as No. 5A, the secondary is equipped with three taps, generating three, six and nine volts. As with the other transformers manufactured by this company, every care has been taken to render this transformer indestructible. It is inclosed in a steel case and immersed in an insulating compound that makes it impervious to moisture. Each transformer is equipped with a plug and a supply of flexible cord so that it may be attached to any alternating-current lamp socket.

Thordarson Toy Transformer.

These transformers are extremely popular with the boys. They are really miniature power plants and the uses to which they may be put are limited only by the ingenuity of the experimenter.

The larger size transformers, which have proven so popular in former years, will continue to be carried. They furnish current at from 3 to 26 volts and 3 to 19 volts.

Electrical Apparatus Uninjured by Submersion During Floods.

The severe floods in many parts of the country have brought to light some interesting information regarding the dependability of electrical apparatus.

The Gray Coal Company, Danville, Ill., has two 35 and two 25-horsepower motors in its development on the Vermillion River in Illinois. One of the 35-horsepower motors was completely submerged in March, 1912, owing to an ice jam which backed up the river water, and remained so for 92 days. It was then protected from the weather and left on the bank of the river till the early fall, when the service of another motor was required and it was tested out to determine its condition. The test showed it to be all right, much to the surprise and gratification of its owners, and so it was im-

mediately put into service again, operating until March 24, 1913, when it was again submerged during the heavy spring flood and remained under water until April 7, when it tested out O. K. The other 35-horsepower motor was submerged last January and remained under water for 10 days. It was then dried out and connected up and found to be in perfect condition. One of the 25-horsepower motors was also submerged, yet when tested out after the waters had receded it was all right.

Some time ago a standard motor performed remarkable service when submerged. A 20-horsepower, three-phase, 220-volt induction motor geared to a mine pump at the bottom of a shaft in the mines of the Richmond Iron Works, Richmond Furnace, Mass., was submerged by surface water that flooded the shaft during a thaw. Although two feet below the surface of the water, the motor continued to operate perfectly and at the end of two hours had pumped itself clear of water. It was then shut down just long enough to clean the dirt and chips from the rotor and to put oil in the bearings, after which it was put into regular service again, pumping 20 hours a day. Its performance since shows that it was uninjured by its remarkable experience.

Motors in the Comstock mines were submerged with water having a temperature of 165 degrees Fahrenheit for 24 hours. After operating for a few hours with the impressed voltage reduced to dry them out, the normal load was thrown on. The motors were not damaged, although a telephone receiver was melted out of shape and warts were raised on it.

In the works of the Sweet & Doyle Foundry & Machine Company and the Twinvolute Pump & Manufacturing Company, of Green Island, N. Y., three motors and a switchboard were completely submerged during the flood in the latter part of March. When the waters had subsided the dirt was washed off and the motor bearings cleaned and oiled. After an hour's run with no load to dry them out, the motors were put into service and apparently had suffered no injury.

The apparatus which passed unscathed through the unusually severe tests mentioned above was manufactured by the General Electric Company, Schenectady, N. Y.

Two remarkable performances of Crocker-Wheeler motors were recently brought to light by a representative of the Crocker-Wheeler Company who was on a business trip through California.

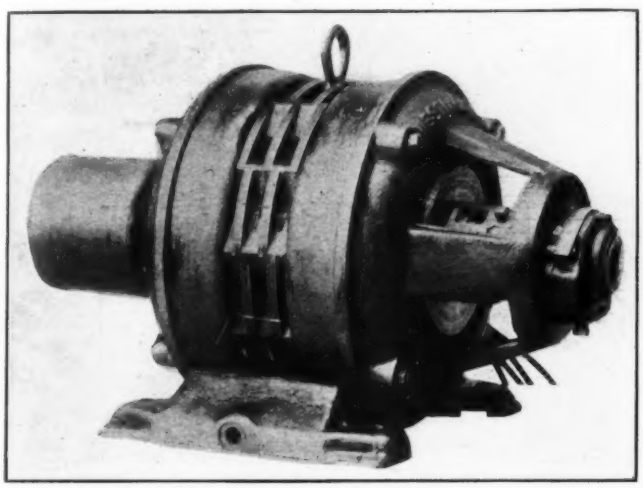
A ranch man, W. E. Green, of Tulare, Cal., has a Crocker-Wheeler form Q induction motor which he purchased to use in driving a pump for irrigation purposes. One night the power went off and the no-voltage release disconnected the motor, stopping the action of the pump. The water during the night backed up from the irrigation ditch into the pit where the motor and pump were installed until the set was submerged in four feet of water. In the morning the ranch man, who had not noticed that the motor was flooded, turned on the current and started the set, which ran from ten to fifteen minutes under water when he discovered to his surprise that the motor was submerged. The machine was taken out, dried in an oven and immediately put into service again. It has been continuously running without repair or extra attention ever since.

A somewhat similar occurrence was reported by Sturgeon & Saults, who had also purchased a similar motor for irrigation service. In this case the water backed up from the ditch into the pit while the set was running and submerged both the pump and the motor. The set, however, continued to run until the pump became so clogged with dirt that the fuses of the switch blew out. The farmer, having cleaned the pump and pit, started the set again without further precautions and this set also has been running satisfactorily ever since.

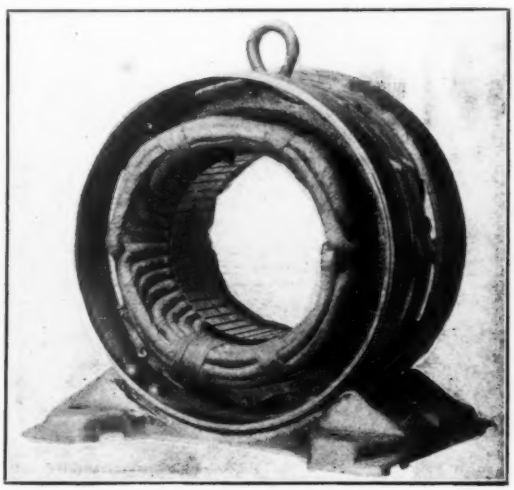
While the Crocker-Wheeler Company has made in certain instances specially insulated waterproof apparatus, the two motors mentioned above were standard stock machines for which no claim was made that they would operate under water.

A New Westinghouse Single-Phase Motor.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has placed on the market a new line of single-phase motors made in capacities of from 2 to 10 horsepower and suitable for the majority of constant-speed applications within their capacities.



Westinghouse Single-Phase Motor.



Stator of Single-Phase Motor.

This motor is of the repulsion-starting type and when up to speed runs as an induction motor. For most applications, it can be connected directly to the line but where very low starting current is desired, a starting rheostat can be used.

The frame is so designed that it combines great strength and radiating capacity with minimum weight and over-all dimensions. The laminations are riveted together under pressure and pressed-steel end plates are riveted to the unit thus formed. The foot, or base, is of pressed-steel plate securely riveted to the end plates. This use of pressed steel marks an important step forward in the design of large single-phase motors.

The bearings are large and dustproof. The rotor coils are form-wound and arranged to permit excellent ventilation. The commutator is of the radial type with undercut mica segments. The shaft can be pressed out of the rotor without disturbing the windings or the commutator. Each motor can be arranged for operation on either 110 or 220-volt circuits.

The Martin Rotary Converter.

The Martin rotary converter and synchronous motor illustrated herewith has been developed by S. H. Martin, of the Northwestern Electric Company, Chicago, Ill., to replace motor-generator sets and rectifiers for obtaining direct current for any purpose from single or polyphase circuits. It has all the advantages of an ordinary rotary combined with the starting characteristics of a squirrel-cage induction motor without the possibility of hunting.

Martin Rotary Converter.

The arrangement of the magnetic circuits is such that no high voltage is generated in the shunt-field winding and the same can, therefore, be connected permanently, making the machine as simple to operate as an ordinary motor. The same is true of the machine as a synchronous motor, both having a power-factor of 100 per cent or even leading, and an efficiency which compares favorably with an ordinary direct-current generator or motor of the same capacity.

In general appearance the rotary converter is similar to a direct-current generator to whose armature a set of slip rings has been added. In mechanical details it conforms to the highest standards of construction in this work. The field consists of a cast-steel yoke on the inwardly projecting poles of which the shunt fields are placed. The laminated steel damper ring has a driving fit on the inside of the field poles. The armature consists of a slotted core of laminated iron assembled on a heavy spider in the larger sizes and on the shaft in the smaller sizes. The commutator and slip rings are also carried on the shaft at opposite ends. The shaft is heavy and is designed to carry the weight of the armature at a very low fiber stress.

In the Martin rotary converter an effective method for the prevention of hunting has been adopted. The damper ring above mentioned is constructed with copper bars connected at each end similar to the rotor of a squirrel-cage motor, thus preventing the relative position of the rotary converter armature from being changed by the corrective current more than the initial change in the generator. The action is essentially a damping action and is similar to that of the copper damper used in galvanometers. The damper ring is connected so as to give the starting characteristics of a squirrel-cage motor and also has windings for preventing magnetic leakage and maintaining power-factor with good regulation.

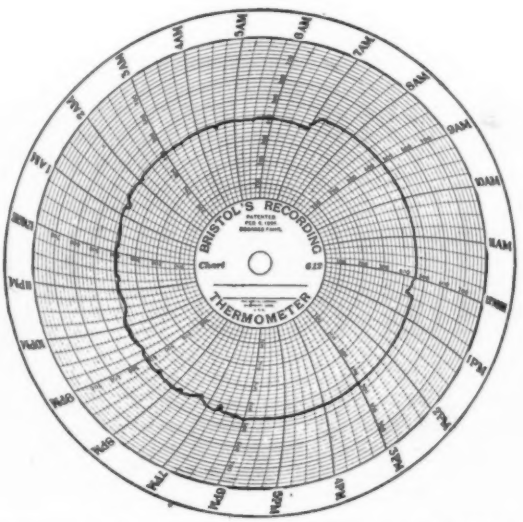
At the present time the Martin rotary converters are made in capacities ranging from 2.5 to 50 kilowatts for operation on 25, 30 and 60-cycle circuits.

Automatic Regulation of Superheat.

The temperature to which steam will be raised in a superheater depends upon the design of the superheater, the amount of tube surface, the number of passes which the steam makes through the surface, the weight of steam passing through the superheater, the volume of hot gases passing over the superheater tubes, and the temperature of these gases. Among the possible methods of controlling superheat temperature are: first, to regulate the volume of steam passing through the superheater tubes so that, after it has been mixed with saturated steam from the boiler, the mixture will have the desired superheat; second, to regulate the amount of hot gases passing over the superheater tubes so that the desired temperature is obtained for any weight of steam passing through the superheater tubes.

The first method is open to the objection that hot gases are always flowing over the tubes, and therefore if no steam or only a small quantity of steam is passing through the tubes they are liable to overheating.

The arrangement of Heine superheaters is such as to obtain temperature regulation by the control of flow of hot gases. The superheater is located in a firebrick superheater chamber, forming part of the boiler setting, at the side of the boiler drum. The rear of this superheater chamber communicates with the furnace by a flue, through which a small percentage of the furnace gases rise, making two passes over the superheater tubes, and then flowing out to the front of the superheater chamber, where a damper is located.



Temperature Record of Automatic Superheat Regulation.

An automatic temperature regulator controls the damper opening, so as to give constant superheat. This automatic regulator comprises two principal parts, a diaphragm lever, actuated by compressed air, and a thermostat controller which regulates the admission of compressed air to the diaphragm lever, in accordance with the temperature of the steam.

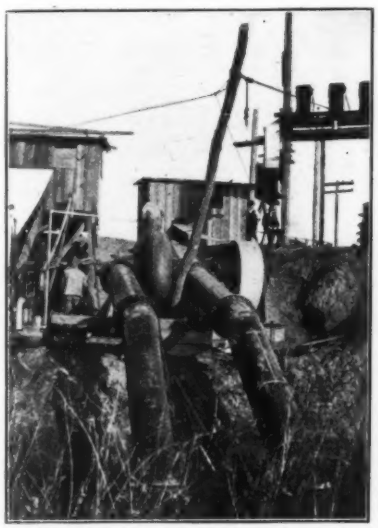
Air enters the top of the diaphragm

chamber, which is a convex casting with a rubber diaphragm across the bottom. Springs hold a " saucer" against the diaphragm, the saucer itself being recessed to hold a link connecting with the lever. When there is no air pressure within the diaphragm chamber the springs press the saucer against the diaphragm and hold it against the inside face of the diaphragm chamber. When air pressure is admitted it overcomes the resistance of the springs and causes the saucer to move downward with corresponding movement of the lever and damper.

The controller for regulating the supply of compressed air to the diaphragm lever is installed in the outlet line of the superheater with a thermostat protruding into a suitable fitting. The thermostat consists of two tubes, one of a metal that changes considerably in length with temperature so that changes in superheat cause changes in relative length of the two tubes. This motion causes changes in the opening of a small ball which controls the supply of compressed air to the lever.

The chart reproduced herewith tells the whole history of the performance of an automatic superheater regulator of this type. In this plant the load comes on at 7 a. m., and as the engines and compressors are started steam is drawn from the superheater and the superheat temperature rises to 460, the setting of the regulator. From then on till noon, the superheat remains absolutely constant. From 12 to 12:30 the engines are shut down, and no steam is drawn from the superheater, which is acting simply as an additional steam-reservoir space. The automatic temperature regulator closes the superheat damper but the temperature of the steam does not immediately fall to boiler temperature, because of the heat stored in the metal of the superheater and the setting. When the load starts up at 12:30, the temperature immediately rises to the normal of 460 degrees and continues until the end of the working day, 6 p. m.. During the night, the boiler is idle, and no steam is drawn through the superheater. The temperature approaches that of the steam in the boiler and the superheater damper is tied shut to positively shut off all gases. During the noon hour and at night, the superheater is not flooded.

An advantage of control apparatus with superheaters is that the temperature may be changed as desired after the plant is installed. The thermostat controller has a small dial and adjusting screw, whereby the mean temperature maintained may be raised or lowered as desired. Thus a plant may be operated for a week or a month at 50 degrees superheat, then 75 degrees, 100 degrees, etc., operating records being kept at the same time of the load and coal consumed. From this a determination may be made of the most economical working conditions.



Electrically Driven Irrigation Pump.

Motor-Driven Irrigation Pump on Barge.

Motor-Driven Irrigation Outfits.

In view of the interest being taken by electric power companies in developing the irrigation fields as a means of selling current, the following examples of motor-driven irrigation outfits installed on the Pacific Coast will undoubtedly prove interesting.

At the irrigation plant of the Moulton Irrigated Land Company, near Princeton, Butte County, Cal., a 30-inch Byron-Jackson centrifugal pump driven by a 150-horsepower Westinghouse induction motor has been installed. This unit is designed to deliver 30,000 gallons at a head of 18 feet, but, due to the rise and fall of the river, the working head varies, and when the river is unusually high, the motor is considerably overloaded.

This condition obtained last spring, and for a period of several days the motor operated continuously at about 225 horsepower, or 50 per cent overload. In spite of these very severe conditions, the motor kept steadily at work, irrigating about 1,500 acres of beans, barley and wheat. If the motor had failed at this particular time, the crop would have been lost.

Power for the motor is derived from the 60,000-volt lines of the Pacific Gas & Electric Company. The voltage is stepped down to 11,000 for transmitting 18 miles, and is then stepped down to 440 volts for the motor.

The cost for installing the irrigating system has not exceeded $15 an acre, while the value of the land has increased $50 to $75 an acre. The cost of irrigation per acre does not exceed $1.25, including labor.

In order to irrigate its rice fields along the Sacramento River, the Moulton Irrigated Land Company has adopted the somewhat unique plan of installing a motor-driven pump on a barge, which is towed from point to point by a gasoline launch and is thus able to accomplish what would otherwise require four stationary plants.

The barge contains a 20-inch Dow centrifugal pump belted to a 100-horsepower Westinghouse induction motor. Power is obtained at the four pumping points from 11,000-volt lines of the Pacific Gas & Electric Company. A bank of transformers on the barge transforms this current to 440 volts for use by the motor.

The pump handles about 16,000 gallons per minute. The head varies from 12 to 23 feet as the river rises and falls, and the motor is overloaded about 30 per cent when the river is at its highest point, but it has carried this overload for considerable periods of time.

Improved Flow Meters.

In the great plants of the present day the economical handling of steam, water, air, etc., depends upon accurate information which will show the total volume transmitted and its instantaneous rate of flow during any interval of time. Only within recent years has this received attention and, as a result, the flow meter has been developed to prevent the enormous waste which has hitherto been winked at and allowed to take place.

The meter shown in the illustrations is designed to meet the requirements of a strong, mechanical meter, which can be used not only as a test instrument, but as a stationary meter for the continuous measurement of either liquids, gases, or vapors.

The body of the flow meter consists of an iron casting cored out so as to form one leg of a U-tube and a reservoir for mercury, the outer leg of the tube being formed by a pipe which opens into the reservoir. The pressure on the surface of the mercury varies with the rate of flow of the fluid being measured, as will be explained later.

A float rests on the surface of the column of mercury in the body of the meter and rises and falls with the corresponding change in its elevation. The float is geared by rack and pinion to a horizontal shaft which carries a permanent U-shaped magnet. The poles of this magnet face a copper cap which closes an opening into the meter body. The remaining parts of the meter's mechanism are mounted on the outside of the cap. A shaft, parallel to the one on which the magnet inside the body is mounted, carries a smaller magnet whose poles are opposite those of the larger magnet, this arrangement serving to transmit motion through the cap without piercing it with a shaft and thus the difficulty of packing such an entrance to prevent leakage is avoided. As the poles facing one another are of opposite polarity, the magnetic flux binds them together so that a movement of the magnet inside the body involves a corresponding movement of the one outside, the latter moving the indicating needle and the recording pen through suitable mechanism.

The pressure which moves the column of mercury in the U-tube is obtained, for pipes two inches and greater in diameter, by inserting a modified form of Pitot tube, termed a "nozzle plug," directly into the pipe line. This can be done without disturbing the piping, except where it is desired to increase the rate of flow at the point of metering, in which case a special pipe reducer is provided. This reducer is made of brass and has a long throat with rounded entrance terminating in a flange. The flange is inserted between the pipe flanges and is held in place in the same manner as a gasket. A special nozzle plug is supplied with the pipe reducer.

The nozzle plug is a tube with two separate conduits in it, each conduit having a set of openings, the two sets being on diametrically opposite sides of the tube. Those on the side of the tube facing the flow are called the leading openings, while those on the opposite side are called the trailing openings.

The flow against the leading openings in the nozzle plug sets up a pressure in the leading conduit which equals the static pressure plus a pressure due to the velocity head. The flow past the trailing openings causes a suction which lowers the pressure in the trail-conduit. As these conduits are connected to the U-tube by one-fourth-inch pipes, the column of mercury is affected by this unbalanced pressure causing a movement of the float. The leading set of openings in the nozzle plug extends approximately across the pipe diametrically, so as to make the velocity pressure transmitted to the meter the mean velocity pressure rather than that at a single point in the pipe.

The chart on which the pen records are made is rotated by a clockwork at a suitable speed. The recording pen sweeps the chart radially and the resulting curve shows the rate of flow at any time during the chart cycle.

The integrating device consists of a stationary flow-rate planimeter driven by the chart paper. The angular position of the planimeter wheel is determined by a cam connected to the shaft of the recording pen and moving with this pen. The planimeter dials read in arbitrary units, which, multiplied by a constant furnished with the meter, gives the flow in the desired unit. This device is extremely simple and there is practically no danger of its getting out of adjustment.

For pipes less than two inches in diameter, an orifice tube, which is a brass pipe tapered internally from both ends and so as to form a restricted opening at the

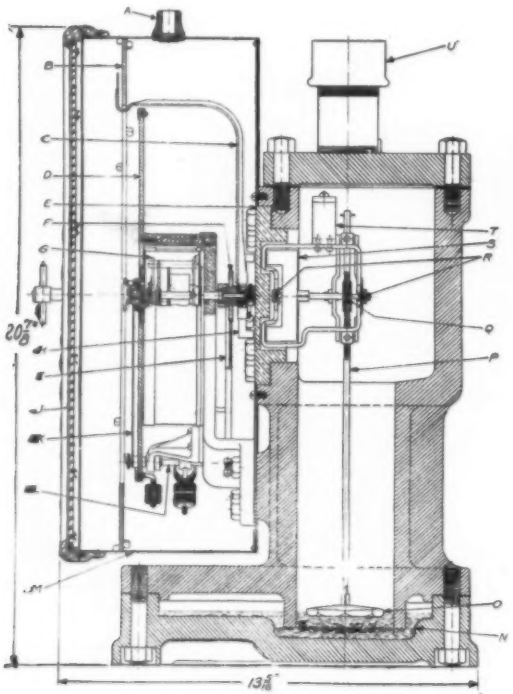


Fig. 1.—Cross-Section of General Electric Flow Meter for Steam and Other Fluids.

Fig. 2.—Internal Mechanism in Body of Meter.

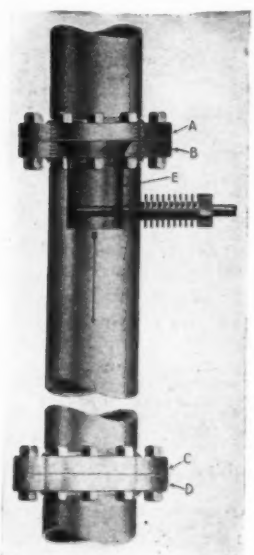


Fig. 3.—Pipe Reducer and Nozzle Plug Installed in Pipe.

middle of the tube, is provided, and it must be incorporated in the pipe line. One leg of the U-tube is connected to the orifice tube near its end and the other leg to its middle point where the greater velocity at the orifice will give a reduced pressure in the pipe leading to the U-tube.

To meet the requirement of different classes of service and the various conditions met with, the meter can be made up in four different ways; first, as a recording or curve-drawing instrument; second, with both indicating scale and recording chart; third, with recording chart and integrating dials; fourth, with indicating scale, recording chart, and integrating dials.

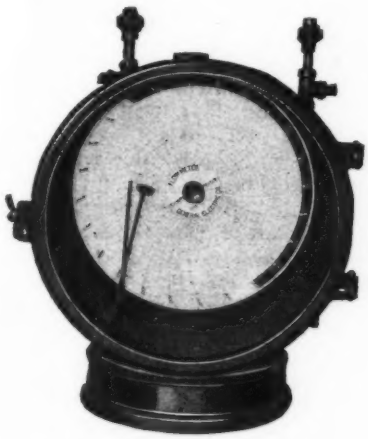


Fig. 4.—Recording Flow Meter.

Some of the large companies have found that flow meters pay for themselves in a short time. With their use the record of the performance of the apparatus shows whether it is operating at the greatest efficiency or not. Surprising conditions have been brought to light by their use, showing at once how indispensable they are. A flow meter on each boiler of a battery running in multiple on the same header shows just what each is doing and permits adjusting the operation of the units so that each will carry its full share of the load. They also indicate immediately whether the load has increased or the steaming rate of the boilers decreased in case the steam pressure begins to drop.

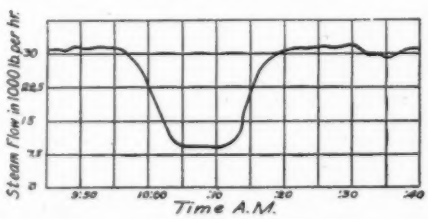


Fig. 7.—Curve from Recording Meter Showing Fall in Flow Due to Defective Fire.

Moreover, from the graphic record of steam pressure it is possible to determine whether the method of firing can be made more efficient or not.

In a big plant the use of flow meters makes it possible to segregate the costs of the steam, water, etc., so that each department can be charged with its share of the costs of these.

In office buildings, the steam used in heating each office can be measured, thus determining just what the heating of each office costs. It will also record the amount of water used, thus serving as a means to check the wasteful use of water. A study of the feed-water chart will determine the rate at which the feed water should be supplied to secure the highest degree of efficiency. These illustrations of the application of the flow meter serve to show the valuable service it renders.

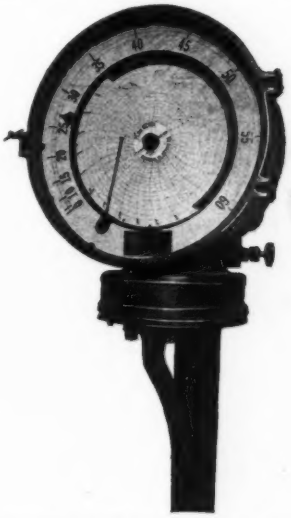


Fig. 5.—Indicating and Recording Meter.

The flow meter described above is manufactured by the General Electric Company, Schenectady, N. Y.

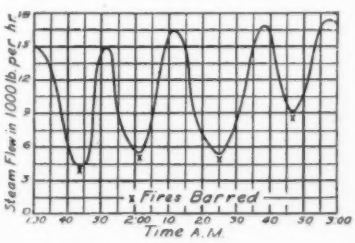


Fig. 8.—Curve Showing Periodic Fall in Steam Flow Due to Defective Worm in Stoker.

A New Iron-Loss Voltmeter.

The Westinghouse Electric & Manufacturing Company has recently introduced a new iron-loss voltmeter having a movement similar to the type PC meters described recently.

This meter, Fig. 1, is for use in connection with a wattmeter for determining the iron loss in distributing and power transformers on the basis of sine-wave voltage and normal frequency, when the testing is done on a circuit of any wave-shape and frequency approximately normal.

The iron loss in a transformer varies with the wave-shape and frequency. Guarantees are, therefore, based on sine wave and a normal frequency; but the standard conditions are difficult to obtain in practice. However, for any other wave-shape and frequency, there is some equivalent voltage that will produce the same iron loss as would the sine wave of normal frequency at normal voltage. The iron-loss voltmeter enables the tester to adjust to this equivalent voltage for the circuit at hand.

Fig. 6.—Indicating, Recording and Integrating Meter.

Fig. 1.—Iron-Loss Voltmeter.

This voltmeter consists of a wattmeter movement in series with the wind-

ing on an iron core *I* as shown in Fig. 2. With this connection the meter element measures the loss in the iron core. The scale is calibrated on a circuit of sine-wave voltage and is marked in volts. Any circuit that makes the instrument read a certain voltage, therefore, produces the same iron loss as would a pure sine wave of that voltage. If the voltage or frequency of the circuit on which a transformer test is being made is adjusted until the iron-loss voltmeter indicates the rated sine-wave voltage of the transformer being tested, the iron losses in the transformer will be the same as they would be on a circuit of that voltage and sine wave-shape. The instrument does not indicate the voltage of the circuit, but the voltage of a pure sine wave of normal

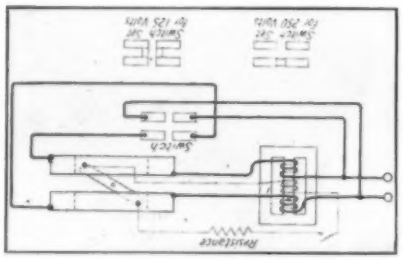


Fig. 2.—Connections of Iron-Loss Voltmeter.

frequency that would cause the same iron loss in the transformer as the wave of voltage of the testing circuit. There is also a watt scale marked on the meter which indicates the total watts consumed in the meter. This is for the correction of wattmeter readings taken when the voltmeter is in circuit.

In application, the iron-loss voltmeter is connected across the terminals of the transformer under test in the same manner as an ordinary voltmeter. A wattmeter is also connected in the circuit in such a way as to measure the total input of both the transformer and the iron-loss voltmeter. The voltage of the circuit is then adjusted by any convenient means until the voltmeter reads the normal voltage of the transformer. The total power input is read on the wattmeter and the watts input of the instrument is read on the watt scale of the iron-loss voltmeter, the difference being the normal loss of the transformer.

New Split Attachment Plug.

A new type of plug has been added to the attachment-plug line of the Cutler-Hammer Manufacturing Company,

Split Attachment Plug.

of Milwaukee, Wis. This split plug, while having the appearance of a solid plug, separates into two halves, facilitating wiring. The saving of time effected in wiring is the feature of greatest importance, especially to the manufacturer using many plugs with his products. Removing the screw shell allows the plug to be separated, exposing large binding-screws to which the cord terminals can be quickly secured. Unlike the usual solid plug there is ample space for the knot and a reducing bushing is supplied so that ordinary cord, silk cord or reinforced cord may be used. The method of locking the screw shell in place after the cord has been secured and the halves placed together is very ingenious. The bottom of the screw shell has a large number of crescent-shaped perforations, one of which, when the shell is screwed in place, engages with a latch, securely locking the shell in place and thus preventing it from being turned backwards and holding the plug together. A friction wiping contact entirely independent of the locking latch makes electrical connection with the screw shell.

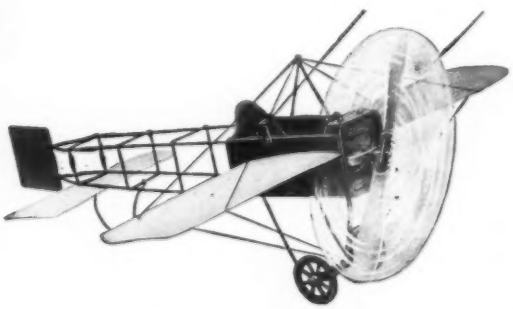
The plug is sent out with the screw shell in place, but not locked, so that it is only necessary to unscrew the shell and wire the plug, after which the halves are placed together and the shell screwed on until locked. If it is desired to unlock it at any time a pen knife or screw-driver can be used to press the latch down, which permits unscrewing the shell. Black heat-resisting Thermoplax is used for the body of the plug, which is of neat, substantial appearance. The small size makes it at once suitable for a great variety of uses for which separable cap plugs are not required.

Details of Split Attachment Plug.

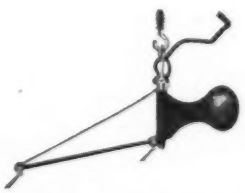
Miniature Electric Aeroplane.

The accompanying illustration shows a miniature aeroplane which has been recently put on the market by the A. E. Rittenhouse Company, Honeoye Falls, N. Y. The aeroplane is equipped with the company's special Aero motor, which will operate on four to eight dry batteries or on direct-current or alternating-current lighting circuits with suitable means of reducing voltage.

The machine is suspended from a swiveled counterbalance by two supporting wires which also serve to carry current to the motor. After closing the motor circuit, centrifugal force throws the aeroplane gradually away from the center, making a very realistic flight. The machine travels in a circle the size of which can be governed by the length of the supporting wires and the speed of motor. The supporting wires are scarcely discernable. The outfit makes a most unique window display and is especially attractive when used with a flasher so that it will make intermittent flights from the floor. The aeroplane is a monoplane pattern after the Bleriot type. It is beautifully enameled and makes a most attractive little machine. The spread of the planes is 22 inches.



Electric Aeroplane.



Suspension and Counterbalance for Aeroplane.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MUSCATINE, IOWA. — Boulevard lighting may be installed on West Second Street. C.

MAYVILLE, N. D.—The present electric light plant will be sold and a new one built. C.

CHARLOTTE, IOWA.—A boulevard lighting system will be installed along Main Street. C.

CLEVELAND, TENN.—Improved electric lights will be established. Address Ben D. Moore.

FREEPORT, MINN.—$6,000 worth of bonds will be issued for the erection of an electric light plant. C.

HARVEY, MINN.—Switchboard and phones will be installed by Manfred & Fram Telephone Company. C.

MILES, IOWA.—A franchise has been granted the Clinton Gas & Electric Company to furnish lights. C.

MANITO, ILL.—The Village Board has authorized the construction of a municipal electric light plant. Z.

VALLIANT, OKLA.—The Council is planning to install a $15,000 light system. Address the city clerk.

SALEM, NEB.—The city plans to install electric lights. Address the city clerk for further information.

VILLISCA, IOWA.—A franchise has been granted to Villisca Public Service Company to furnish electric power. C.

AURORA, MINN.—The Council is considering the installation of additional equipment for the electric light plant.

LAPEER, MICH. — A boulevard lighting system will be installed at a cost of $12,000. Address the city clerk.

WARREN, ILL.—An electric light plant will be established here. Address the village clerk for desired information.

MARSHALLTOWN, IOWA.—The Iowa Railway & Light Company is planning $25,000 worth of improvements to its plant. C.

ADEL, GA.—Additional equipment will be installed in the municipal electric light plant. Address F. R. Sutton, superintendent.

BREWTON, ALA.—The Downing Industrial School is planning to install an electric lighting system at a cost of $55,000.

DALLAS, TEX.—City Electrician Taylor is preparing plans for a lighting system to be installed in the basement of the city hall.

MONTEZUMA, IOWA.—A 25-year franchise has been granted to Montezuma Electric Lighting, Heating & Power Company. C.

DESOTO, ILL.—The Council is planning to install an electric lighting system. Address the city clerk for particulars.

BIG SPRINGS, TEX.—The West Texas Electric Light Company is planning to construct a power house in this city.

NECK, MO.—A M. Baird, of Cartersville, Mo., has been granted a franchise to establish an electric light plant here costing $25,000.

CALLAWAY, FLA.—The St. Andrews Bay Company will build a wood pulp paper plant. An electric light system will be installed.

SAN DIEGO, CAL.—Plans have been prepared in the office of the City Engineer for a new system of ornamental street lighting.

HOUSTON, TEX.—The City Commissioners and Ben T. Campbell, mayor, contemplate the construction of a municipal electric light plant here.

TOMAH, WIS.—Louis W. Barnes will install an isolated electric lighting system, including engine, dynamo, switchboard and usual fixtures.

LOUISVILLE, KY.—E. G. Duckwell & Company will purchase motors for the operation of their new elevator, which will be installed. G.

MARINETTE, WIS.—The Council is planning to install boulevard lighting on River Side Avenue. Address the city clerk for information.

CHANUTE, KANS.—A $100,000 hydroelectric power plant may be installed here. Address Prof. George C. Shaad, of Lawrence, Kans., for particulars.

OSAGE, IOWA.—Ferris Brothers will build a modern concrete dam on Cedar River and install $15,000 worth of machinery for electric power purposes. C.

QUINCY, CAL.—The electric light plant in this city owned by F. G. Gansmor was destroyed by fire not long ago, but is to be rebuilt immediately.

MARCELINE, MO.—$10,000 will be expended for establishing an electric light plant. Address the Mayor for further information in regard to this project.

DULUTH, MINN.—Great Northern Power Company contemplates a wide extension of its transmission lines to supply towns on the Mesaba and other ranges. C.

URBANA, ILL.—The Park Board Plans to expend $6,000 for a lighting system for parks. Address C. D. Rouke, president of Commercial Club, for information.

PHILADELPHIA, PA.—The Blacklick Light, Heat & Power Company, has been incorporated with a capital stock of $5,000 by C. V. Bergh, W. L. Scott and others.

LAKE CITY, FLA.—$7,500 in bonds has been voted to establish an electric light plant here. Address J. C. Young, Commissioner of Public Works, for information.

DAVENPORT, WASH.—The Washington Water Power Company has been granted a franchise and power lines from this city to Almira, via Crescent and Wilbur.

POMEROY, IOWA.—$15,000 bonds have been voted for building a transmission line and equipment, Northern Iowa Power Company, at Humboldt, having secured the franchise. C.

BUTTE, MONT.—The City Council is considering the installation of 320 ornamental arc lights. Cost of installation is estimated at $32,525. For information address the city clerk. O.

COLUMBUS, O.—An ordinance has passed the Council providing for extending the electric light system at a cost of 25,000. Address Mayor Karb for further information.

KLAMATH FALLS, ORE.—An electric light plant owned by the Government, near this city was burned recently, entailing a loss of about $10,000. The plant will be rebuilt at once. O.

ANACONDA, MONT. — The City Council has under contemplation the installation of an ornamental lighting system to cost $33,000. The City Clerk will furnish further information upon request. O.

FORT WAYNE, IND.—Hiser Electric Light & Power Company has been incorporated with a capital stock of $5,000 to sell electric light, heat and power. The incorporators are G. D. and J. Hiser and R. S. Bradley.

NOKOMIS, ILL.—Mayor Joseph H. Weinstein, and members of the City Council have visited municipal electric light plants at Staunton and Mt. Olive, as the installation of a municipal plant is contemplated here. Z.

WEBSTER SPRINGS, W. VA.—The Webster Springs Power Company has been incorporated with $50,000 capital stock by C. L. Benedum, J. W. White and J. R. Randolph, for the development of a power project. G.

MONTEZUMA, IOWA.—Montezuma voted an electric-light franchise to the McKinley interests at Oskaloosa for 25 years. The company will stretch a transmission line from Oskaloosa and will give Montezuma a 24-hour service.

PADUCAH, KY.—Major W. A. Calhoun, consulting engineer of the Kentucky Southwestern Electric Railway Light & Power Company, has prepared plans and specifications for the construction of a central power plant here.

FLORENCE, ORE.—The Electric light plant of this city will be remodelled at once, and the company will be in a position to furnish the city with current both night and day. The power and light lines will be extended from Florence to Glenada. O.

MENA, ARK.—W. B. Crossland, of Newport, has purchased the franchise for the electric lighting plant, under the firm name of De Soto Co-Operative Electric Light & Power Company. Mr. Crossland states that a modern lighting plant will be installed in Mena at once.

SAN FRANCISCO, CAL.—The Pacific Light & Power Corporation has been granted a permit for extensive developments in the San Joaquin drainage project, including the construction of powerhouses and three steel transmission lines to Los Angeles.

CLATSKANIE, ORE.—The local electric light plant, municipally owned, was recently acquired by a syndicate, headed by Mayor W. W. Seymour of Tacoma, Wash. New improvements and equipment will be added at once. For information address W. W. Seymour, Tacoma. O.

ST. MARIES, IDAHO.—H. S. Simmonds, of this city, recently petitioned the Public Service Commission to install a power plant which will be operated in conjunction with the mill of the St. Maries Lumber Company. Light and power will be sold in this city and vicinity as a by-product. O.

MULBERRY, FLA.—The Export Phosphate Company has been incorporated with a capital stock of $1,500. The company is to build a first class mining plant, including electric power houses of about 1,000-horsepower capacity and a hydraulic plant. Address E. L. Blood, general manager, for particulars.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has been granted permission to purchase ditches and water rights of the United Water & Power Company. The rights thus acquired are to be used for the further development of the Bear River hydroelectric projects in Glacer County.

NEW BRITAIN, CONN.—According to a report of the Council Committee on Lighting the city of New Britain will establish and maintain within its limits one or more plants for the manufacture and distribution of electricity for furnishing light for municipal use and for the use of such inhabitants as may desire the service.

LOUISVILLE, KY.—It is reported here that a large water power plant for generating electricity sufficient to supply this city is to be built on the Chaplin River. It is hinted that H. M. Byllesby & Company, of Chicago, are behind the enterprise. It is also stated that a corps of engineers will make surveys and test the flow of the Chaplin River within a month.

CASHMERE, WASH.—O. B. Hollis and M. M. Dickson, of Spokane, recently purchased a hydroelectric proposition from O. M. Carter, J. M. Crom and L. H. Titchenal, of this city, and will begin the construction of a 1,600-horsepower hydroelectric plant at once. The power site is said to be one of the best on the Wenatchee River. The Company has been incorporated with a capitalization of $100,000. O.

McKITTRICK, CAL.—The San Joaquin Light & Power Company has decided to continue its electric line for light and power from this city to Buttonwillow, a distance of about 15 miles. Messrs. Eastman and Berges, general superintendent of construction, and superintendent of the Bakersfield Division, respectively, are making the preliminary preparations for the erection of the poles and wires. T.

COLUMBUS, GA.—The Muscogee Light & Power Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are Edward W. Swift, J. P. Illges, J. P. Kyle, Clifford J. Swift, John T. Davis, Jr., T. E. Golden, O. C. Bullock, E. J. Rankin, John A. Rankin, E. P. Dismukes and Harry L. Williams. It is the purpose of the company to manufacture and distribute electrical energy to corporations and individuals.

SPOKANE, WASH.—The City of Spokane is investigating a proposition of acquiring a municipal power site on the Spokane River, either by purchase or condemnation, upon which a municipal lighting plant, costing approximately $1,000,000, will be built. A conservative estimate places the cost of extending lines and conduit into this city from the plant at another million dollars. The following committee has been appointed by the City Council to investigate the proposition from all phases: City Commissioners Fassett and D. C. Coates; Corporation Counsel H. M. Stephens, City Engineer Morton MacCartney and Water Superintendent A. Lindsay. O.

ST. ELMO, CAL.—The Tin Cup Gold Dredging Company, of Denver, has been issued a permit for a water-power plant to be built at Chalk Creek on the Leadville National Forest near this place. The power will be transmitted across the Continental Divide at an elevation of about 12,000 feet and will be used to operate a gold dredge at Tin Cup. It is planned to begin construction upon the power plant immediately in order that the power may be available at an early date for mining operations. The first installation will amount to about 300 horsepower, but if dredging operations prove successful, more power will be required, involving additional developments upon Chalk Creek.

LOS ANGELES, CAL.—"The Great Light Way," is the leading proposition before the people of this section at the present time. This consists of a string of ornamental electric lights to extend from this city to Long Beach, a distance of about 25 miles. It is proposed to make this the finest lighted way in the United States. This matter is being boosted by such men as Mayor Rose of this city, A. B. Case of the Home Telephone Company, Mayor Hatch of Long Beach, W. H. Rider, president of the Los Angeles Chamber of Commerce, H. P. Barbour, president of the Long Beach Realty Board, Ernest Ingold and Marco Hellman. Just as soon as the lights are assured bids for the construction of "The Great Light Way" will be called for. T.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

FRANKLIN GROVE, ILL.—The Farmers' Telephone Company will place its telephone wires underground. Z.

NORTH WATER GAP, PA.—The Smithfield Rural Telephone Company has been incorporated with a capital stock of $5,000.

WEST, TEX.—The Brazos Valley Telephone Company, of which H. C. Cooke is manager, will expend $10,000 on improving the system.

MONMOUTH, ILL.—The Monmouth Telephone Company is reorganizing for the purpose of building new lines. Address Abner Charles in regard to the matter.

STEVENS POINT, WIS.—The Sharon Farmers' Telephone Company has been incorporated with a capital of $5,000 by Alois Firkus, Joseph Okray and J. J. Omernik.

ELGIN, ILL.—The Chicago Telephone Company contemplates placing its wires in the business section underground and making all pole lines in alleys before 1919. The estimated cost is $100,000.

LOS ANGELES, CAL.—The Hanson Wireless Telephone & Telegraph Company has been incorporated here with a capital stock of $25,000. The incorporators are Charles L. Hanson, Harry LaVerne Twining and Lucius M. Fall. T.

HOT SPRINGS, ARK.—The Southwestern Telegraph & Telephone Company will erect a $100,000 building equipped with facilities for handling 3,000 subscribers. The company will expend $100,000 for placing wires under ground.

POMEROY, WASH.—A. L. Cabbage, W. A. Pearson, T. A. Bartlett, P. C. Nicholson, Otto Munch and James Buttlet have been granted a franchise by the County Commissioners to build a telephone line from Pomeroy to Pataha. Immediate construction will follow.

COVINA, CAL.—The Home Telephone Company has applied to the Railroad Commission for authority to issue $40,000 of bonds and to use the proceeds for building an exchange at Puente and for extending and enlarging its system in the localities in which it operates.

SAN BERNARDINO, CAL.—Plans are under way for the connection of this city with the Palo Verde Valley on the Colorado River by telephone. It is proposed to build a line from Blythe in the Palo Verde Valley to Blamis, southwest of the Southern Pacific line. At that place it will connect with the desert long-distance line to this city. T.

GAINESVILLE, TEX.—The Peoples Home Telephone Company, consisting of exchanges at Denton and Valley View and 115 miles of long-distance lines, has been purchased by Sherman capitalists, who own the Grayson County Telephone Company. F. W. Porter is president. The office here has been taxed to its capacity for some time, but it is understood that it will now be remodeled with new switchboards and up-to-date appliances.

CHICAGO, ILL.—Trunk line construction by the Chicago Telephone Company which will add 5,000 trunk circuits to the system is expected to cost approximately $500,000 by the end of the year. The cost of the construction program for 1914 will be a trifle less, but the added length will be 20 per cent higher, amounting to 120,000 miles of circuit. One new cable alone will be 14,311 feet long and will contain 1,635 miles of wire. It will cost $10,883 at the factory and the cost of installation will bring the total cost up to $13,000.

SAN FRANCISCO, CAL.—From the office of the National Forest Service in this city a report has been issued to the effect that the Secretary of Agriculture has granted the following rights of way to the city of Los Angeles for power transmission and telephone lines across the national forest lands. For an electric power transmission line 17 miles in length within the Kern Forest, a telephone line 68 miles long in the same forest and a telephone line within the Santa Barbara Forest. Each permit will run for 50 years and all the lines will be used by the city of Los Angeles in connection with the aqueduct system. T.

ELECTRIC RAILWAYS.

(Special Correspondence.)

TAYLORSVILLE, KY.—A trolley line to Jeffersontown is projected by citizens of this community, who are now engaged in securing the necessary rights of way. G.

MADISON, WIS.—The Common Council has granted a franchise to the Chicago & Wisconsin Valley Street Railways Company to build a line through the city. Z.

LAPORTE, IND.—Indications are that the Laporte, Logansport & Southern Interurban Company have decided to start work on the line of the Rochester-Logansport electric railway.

BUNKER HILL, ILL.—The Village Board has granted a franchise to the St. Louis, Belt, Bunker Hill & Eastern Railroad to construct and operate an electric interurban line through the city. Z.

EVERETT, WASH.—The Northern Pacific Traction Company has been granted a franchise to construct, operate and maintain electric trolley lines in this city. Work will be ordered in the immediate future. O.

LAPORTE, IND.—R. C. Dunlap, a Chicago civil engineer, is securing right of way in Lake, Porter and Laporte counties, Ind., for a proposed electric line which is to be constructed from St. Joseph, Mich.

PASADENA, CAL.—The Pacific Electric Railway Company has decided to retain its franchise on North Main Street and to begin construction on the new line within a short time. This line will be a single track affair. T.

AUSTIN, TEX.—The Dallas Southwestern Traction Company has filed articles of incorporation for the purpose of erecting a traction line from Dallas to Glen Rose, via Cleburne, a distance of 80 miles. The capital stock of the company is $500,000.

SAN ANSELMO, CAL. — The San Rafael & San Anselmo Railway Company has been granted a street railway franchise in this city. The company proposes to connect this city with Fairfax and San Rafael, giving each of the three cities a street car system.

HORNELL, N. Y.—Officers of the Hornell Traction Company have received a permit from the State Highway Department giving them permission to lay an electric railroad from the Shawmut Railroad station along the North Hornell state highway to the Canisteo River.

PORTLAND, ORE.—The East Thirty-Second Street Improvement Club recently petitioned the City Commissioners for a street railway on East Broadway. The East Broadway Neighborhood Club, and the Beaumont Club are co-operating in the movement, and in all likelihood the line will be constructed. O.

SENECA FALLS, N. Y.—The Geneva & Auburn Railway Company has been succeeded by the Geneva, Seneca Falls & Auburn Railroad Company, capitalized at $724,000, the majority of the stock being held by Pennsylvania oil and traction magnates. It is expected that the trolley line between this village and Geneva will be extended to Cayuga Lake and Auburn.

MILWAUKEE, ORE.—The East Milwaukee Push Club, recently organized, is agitating the proposition of an electric line through the Reed College, Ardenwald, Harmony and Clackamas Districts. The Hill interests will be petitioned to build the line and if they refuse, other companies will be asked to take hold of construction work. C. P. Hanson, of this city, is president of the organization. O.

BUFFALO, N. Y.—The Frontier Electric Railway Company, which has been organized to build another trolley line from Buffalo to Niagara Falls, has acquired nearly all of the right of way and construction work will be started in the spring. It is expected that $5,000,000 will be expended in the construction of the road, purchase of equipment and the acquirement of property.

NASHVILLE, TENN.—Application has been made for a charter for the Cumberland Valley Railway Company. The capital stock is set at $10,000 and the incorporators are J. H. Cartwright, Homer Hancock, W. G. Beard, J. W. Jenkins and about 20 other citizens, of Davidson, White and DeKalb Counties. It is proposed that the company shall operate an electric interurban line from Nashville to Sparta by way of Smithville.

OMAHA, NEB.—Articles of incorporation have been filed for the Omaha & Lincoln Railway & Light Company, a $750,000 concern promoted by Ex-congressman W. D. McKinley of Illinois, who recently bought the Nebraska Traction Company Papillion line. This is the second interurban planned between Omaha and Lincoln, the other being the Omaha, Lincoln and Beatrice line, which has been approved by the State Railway Commission, and upon which work, it is expected, will shortly begin. It is backed by the Commonwealth Power Company and the Sharp interests of Detroit.

PROPOSALS.

CLUSTER LIGHT SYSTEM.—Bids will be received on August 4 for furnishing materials and labor necessary for the installation of a cluster lighting system in Local Improvement District No. 17. Address Stuart H. Taylor, city clerk.

ELECTRICAL WORK. — Austin Orr, Township Trustee, Scirceleville, Ind., will let the contract for the electrical work to be done in this place. Architect J. T. Johnson, State Life Building, Scircleville, has prepared the plans.

ELECTRICAL WORK.—Bids will be received until August 7 for constructing heating, plumbing and electrical work at the state Custodial Asylum. Architect Lewis F. Picher, of Albany, N. Y., has prepared plants, and may be addressed in regard to the matter.

CONDUIT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until August 19 for furnishing miscellaneous galvanized steel conduit, as per Schedule 5,668, to be delivered at the Navy Yard, Puget Sound, Wash.

ELECTRICAL FITTINGS.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until August 12 for furnishing the annual supply of Perfex igniters and spark plugs, as per Schedule 5,673, to be delivered at the Navy Yard, Brooklyn, N. Y.

ELECTRIC WIRE.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until August 5 for furnishing large quantities of cable, as per Schedule 5,650, and lighting and power and telephone wire, as per Schedule 5,649, all to be delivered at the Navy Yard, Brooklyn, N. Y.

ELECTRICAL WORK. — Sealed proposals will be received by the School District of the Borough of Carlisle until August 4 for the electrical work of a high school building. Drawings and specifications may be seen at the office of the Secretary or may be procured upon application to C. Howard Lloyd, architect, Harrisburg, Pa.

ELECTRIC LAMPS.—Bids will be received by the State Board of Control, Topeka, Kans., until August 5 for furnishing electric lamps for the state charitable institutions of Kansas for a period of one year from date of contract. Contract will be awarded upon a basis of 8,000 lamps, delivered as ordered by the chief executive officer of 12 institutions.

CONDUITS AND WIRING.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until August 7, for a conduit and wiring system in the United States Marine Hospital, Memphis, Tenn., in accordance with drawings and specifications, copies of which may be obtained from the custodian of the site or the office of the Supervising Architect.

UNDERGROUND ELECTRIC TRANSMISSION LINE.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until August 30, for installing an underground electric transmission line from the Boston Navy Yard to the Naval Hospital, Chelsea, Mass., a distance of approximately one mile. Plans and specifications may be obtained on application to the Bureau at Washington.

WIRING.—Sealed proposals will be received by the Department of the Interior, Washington, D. C., until August 15 for furnishing all labor and material which shall be required in requiring the third floor and galleries of the Patent Office Building at Washington, in accordance with drawings and specifications, copies of which may be obtained from the chief clerk of this department. Proposals should be endorsed "Proposal for Rewiring Patent Office Building," and be addressed to the Secretary of the Interior.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Foreign and Domestic Commerce, Washington, D. C., and refer to the file number noted.)

NO. 11,341. CABLES, TELEPHONES, SWITCHBOARDS, ETC.—The Postmaster General at Melbourne, Australia, invites tenders for 105 miles of paper insulated lead covered cable (Schedule 906), 300 coin collecting devices, electrically controlled (Schedule 916), telephones (Schedule 301), switchboards (Schedule 302), electric lamps (Schedule 304). Particulars may be obtained of the High Commissioner for Australia, 72 Victoria Street, London, England.

FINANCIAL NOTES.

The Western Power Company has sold $1,250,000 collateral trust six-per-cent two-year notes, dated July 18, 1913.

The California Railroad Commission has authorized the San Joaquin Light & Power Corporation to issue $1,776,000 bonds. The company was also given authority to pledge these bonds for an issue of two-year, six-per-cent collateral trust notes. It was provided that notes may be issued up to 75 per cent of the bonds pledged. The proceeds from the sale of the bonds or notes will be used by the company in completing its power house, substations and transmission lines in connection with its new hydroelectric work.

The Interborough Rapid Transit Company has made application to the New York Stock Exchange to list $37,027,000 first and refunding mortgage, five-per-cent gold bonds. In all, some $160,000,000 of these bonds will be issued and listed from time to time. Of the total $37,027,000 to be listed at present about $5,000,000 have been exchanged for the old first mortgage bonds of the company on the basis of 105 for the old bonds and 98 for the new. Of the balance, half will be used for retiring note obligations and half for new construction. The total authorized issue of first and refunding five-per-cent bonds is $300,000,000, dated January 1, 1913.

Dividends.

Connecticut Railway & Lighting Company; regular quarterly of one per cent on preferred and common, payable August 15 to stock of record July 31.

Detroit United Railway; the regular quarterly dividend of 1.5 per cent, payable September 1 to stock of record August 16.

Kings County Electric Light & Power Company; regular quarterly dividend of 2 per cent, payable September 2, to stock of record August 21.

Monongahela Valley Traction Company; the regular semi-annual dividend of 2.5 per cent, on its preferred stock, payable August 1.

Ohio Traction Company; a quarterly preferred dividend of 1.25 per cent, payable August 1 to stock of record July 26.

Omaha Electric Light & Power Company; a semi-annual preferred dividend of $2.50 per share, payable August 1 to stock of record July 21.

Texas Power & Light Company; quarterly of 1.75 per cent on preferred, payable August 1 to stock of record July 25.

Toledo, Bowling Green & Southern Traction Company; a quarterly preferred dividend of 1.25 per cent, payable August 1 to stock of record July 21.

Reports of Earnings.

WESTERN POWER COMPANY.

Earnings of Western Power Company, for twelve months ended June 30, 1913, compared with 1912, follow:

	1913.	1912.
Gross earnings	$2,538,126	$2,063,215
Net after taxes	1,530,358	1,268,797
Total income	1,627,782	1,278,373
Balance after charges, and including guaranteed dividends	396,002	

OTTUMWA RAILWAY & LIGHT.

The Ottumwa Railway & Light Company reports earnings for the 12 months ended June 30, 1913, as follows:

	1913.	1912.
Gross earnings	$310,204	$293,647
Net after taxes	137,513	132,766
Surplus and charges	71,316	66,713
Preferred dividends	31,493	29,745
Balance	39,823	36,968

LEHIGH VALLEY TRANSIT COMPANY.

	1913.	1912.
June gross	$ 148,221	$ 129,982
Net after taxes	83,006	73,534
Surplus after charges	36,488	31,325
Twelve months gross.	1,661,961	1,438,231
Net after taxes	952,101	808,273
Surplus after charges	417,511	325,145

MEXICAN TELEGRAPH & TELEPHONE.

The report of the Mexican Telegraph & Telephone Company for the three months ended May 31, 1913, compares as follows (Mexican currency):

	1913	1912
Gross	$171,150	$188,557
Net	86,277	87,118

MOUNTAIN STATES TELEPHONE & TELEGRAPH.

The income account of the Mountain States Telephone & Telegraph Company for the five months ended May 31, 1913, compares as follows:

	1913	1912
Gross	$2,982,403	$2,652,291
Expenses	1,937,971	1,637,589
Net	1,044,432	1,014,702
Dividends	818,727	660,824
Surplus	225,707	353,879

ONTARIO POWER COMPANY OF NIAGARA FALLS.

The combined income account of the Ontario Power Company of Niagara Falls and Ontario Transmission Company, Limited, as reported to the New York Stock Exchange for the year ended December 31, 1912, follows:

Gross earnings	$1,163,525
Net earnings	992,090
Other income	22,286
Total income	1,014,377
Surplus after charges	365,441

INTERBOROUGH'S EARNINGS UP.

The report of the Interborough Rapid Transit Company for the year ended June 30, 1913, shows net earnings of $19,237,127, against $18,198,590 in 1912. The balance available for dividends was $6,537,068, equal to 18.67 per cent on the capital stock, as compared with 18.63 per cent earned the previous year. The income account for the fiscal year compares as follows:

	1913.	1912.
Gross operating revenue	$32,497,871	$31,246,392
Operating expenses	13,260,743	13,047,802
Net operating revenue	19,237,127	18,198,590
Taxes	2,116,880	1,979,431
Operating income	$17,120,247	$16,219,159
Other income	487,490	†1,305,200
Total income	$17,607,737	$17,524,360
*Interest	11,070,669	11,000,593
Net cor. income	6,537,068	6,523,766
Dividends	4,200,000	5,250,000
Surplus	$2,337,068	$1,273,766
Passengers carried	634,316,516	607,244,697

*Rent, etc., including Manhattan Railway guarantee. †Includes first dividend 15 per cent ($900,000) on stock of Rapid Transit Subway Construction Company.

KINGS COUNTY ELECTRIC LIGHT & POWER.

	1913.	1912.
June gross	$ 443,599	$ 398,861
Net after tax and depreciation	167,695	131,241
Other income	5,410	4,268
Total income	173,105	135,509
Surplus after charges.	101,907	62,145
Six months gross	2,788,686	2,598,855
Net after tax and depreciation	1,071,365	968,103
Other income	32,170	28,551
Total income	1,103,536	996,655
Surplus after charges	656,192	559,929

VIRGINIA RAILWAY.

The report of the Virginia Railway & Power Company for the year ended June 30, 1913, shows net earnings of $2,447,119. against $2,135,290 the previous year. The income account for June and the twelve months compares as follows:

June—	1913.	1912.
Gross	$ 418,962	386,620
Net	221,086	178,779
Other income	7,550	6,349
Total income	228,636	185,128
Surplus after charges	100,427	64,533
Twelve Months—		
Gross	$4,864,107	$4,558,193
Net	2,447,119	2,135,290
Other income	86,703	69,158
Total income	2,533,822	2,204,448
Surplus after charges	1,033,321	781,247

PHILADELPHIA RAPID TRANSIT.

The report of the Philadelphia Rapid Transit Company for the year ended June 30, 1913, shows net earnings of $9,721,423, as compared with $8,751,860 the previous year. The income account compares as follows:

	1913.	1912.
Gross revenue	$23,927,179	$22,700,691
Oper. expenses and taxes	14,205,755	13,948,831
Net revenue	$9,721,423	$8,751,860
Interest and rent	9,091,840	8,902,350
Sinking fund city contract	120,000	.....
Surplus	$509,582	*$150,489

*Deficit.

WEST PENN TRACTION AND WATER POWER COMPANY.

The West Penn Traction and Water Power Company, for the year ended June 30, 1913, showed gross earnings of $4,181,728, an increase of $1,515,433, and net earnings of $1,839,389, an increase of $548,723. The statement compares as follows:

	1913.	1912.
Gross earnings	$4,181,728	$2,666,295
Oper. expenses and taxes	2,342,339	1,375,629
Net earnings	$1,839,389	$1,290,666
Fixed charges	1,047,468	623,429
Balance	$791,921	$667,237
Guaranteed dividends	235,000	235,000
Surplus	$556,921	$432,237

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	July 28.	July 21.
American Tel. and Tel. (New York)	127¼	127½
Commonwealth Edison (Chicago)	142	138
Edison Electric Illuminating (Boston)	270	*275
Electric Storage Battery common (Philadelphia)	47½	45
Electric Storage Battery preferred (Philadelphia)	47½	45
General Electric (New York)	140	139
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1½	1⅝
Massachusetts Electric common (Boston)	14½	14½
Massachusetts Electric preferred (Boston)	71	70½
National Carbon common (Chicago)	114½	*113
National Carbon preferred (Chicago)	113	*111
New England Telephone (Boston)	140½	140
Philadelphia Electric (Philadelphia)	22	22
Postal Telegraph and Cables common (New York)	75½	76
Postal Telegraph and Cables preferred (New York)	65	65
Western Union (New York)	64½	62
Westinghouse common (New York)	62½	59½
Westinghouse preferred (New York)	108	106

*Last price quoted.

THIRD AVENUE EARNINGS.

Third Avenue Railway Company reports earnings for the month of June as follows:

	1913.	1912.
June gross	$999,571	$869,003
Net after taxes	410,942	229,216
Other income	19,803	21,850
Total income	430,745	251,066
Charges and depreciation	162,266	144,648
Balance	268,479	106,418
Interest on adj. bonds	93,900	.....
Net income	174,579	106,418

ONTARIO POWER COMPANY.

The Ontario Power Company of Niagara Falls and the Ontario Transmission Company, Limited, report income and expenses, with inter-company payments eliminated, as follows for the six months ended June 30, 1913:

	1913.	1912.
Sales of power	$724,040	$570,607
Government rentals	37,107	31,835
Total gross	686,933	538,771
Net after taxes	597,215	451,104
Other income	11,903	11,204
Net income	609,118	462,309
Interest charges	339,083	323,793
Surplus	270,034	138,516

Earnings of the Ontario Transmission Company, Limited, for the six months ended June 30, 1913, as reported separately from combined statement were:

Transmission line rental	$115,213	$95,233
Bond interest	48,375	45,693
Surplus	66,838	49,540

AMERICAN GAS & ELECTRIC SUBSIDIARIES.

The Canton Electric, the Marion Light & Heating, the Muncie Electric Light, the Rockford, the Scranton Electric and the Wheeling Electric, subsidiaries of the American Gas & Electric Company, are reported by the Electric Bond & Share Company for June, 1913, and the twelve months ended June 30, 1913, as follows:

CANTON ELECTRIC.

	1913.	1912.
June gross	$ 30,919	$ 23,689
Net	15,565	9,518
Surplus after charges	9,843	4,751
Twelve months gross	370,486	328,984
Net	186,840	161,993
Surplus after charges	129,017	104,864

MARION LIGHT & HEATING.

	1913.	1912.
June gross	$ 17,536	$ 16,437
Net	7,536	3,072
Surplus after charges	3,769	*128
Twelve months gross	239,116	209,602
Net	104,259	87,755
Surplus after charges	60,939	51,712

MUNCIE ELECTRIC LIGHT.

	1913.	1912.
June gross	$ 32,766	$ 28,501
Net	12,707	9,238
Surplus after charges	5,661	2,787
Twelve months gross	428,612	350,076
Net	185,818	150,353
Surplus after charges	100,471	76,292

ROCKFORD ELECTRIC COMPANY.

	1913.	1912.
June gross	$ 31,705	$ 28,374
Net	16,001	13,270
Surplus after charges	7,967	5,455
Twelve months gross	438,888	401,968
Net	227,840	193,349
Surplus after charges	132,807	99,931

SCRANTON ELECTRIC COMPANY.

	1913.	1912.
June gross	$ 62,509	$ 56,716
Net	33,435	28,767
Surplus after charges	16,380	16,515
Twelve months gross	858,690	769,384
Net	509,723	436,635
Surplus after charges	338,247	293,464

WHEELING ELECTRIC COMPANY.

	1913.	1912.
June gross	$ 24,832	$ 18,272
Net	10,233	8,670
Surplus after charges	5,019	4,631
Twelve months gross	288,257	242,696
Net	130,177	121,544
Surplus after charges	64,339	76,079

*Deficit.

E. W. CLARK & COMPANY PROPERTIES.

Bangor Railway & Electric, Grand Rapids Railway, Lewiston, Augusta & Waterville Street Railway and Portland Railroad Company, under the management of E. W. Clark & Company, report earnings for May, 1913, and twelve months ended May 21, 1913, as follows:

BANGOR RAILWAY & ELECTRIC COMPANY.

	1913	1912
May gross	$ 60,285	$ 53,790
Net after taxes	32,198	29,772
Surplus after charges	15,062	13,274
Twelve months gross	736,500	643,612
Net after taxes	402,260	348,437
Surplus after charges	198,032	174,057

Surplus after charges for twelve months are equivalent to 4.7 per cent on the common stock after payment of preferred dividend.

GRAND RAPIDS RAILWAY.

	1913	1912
May gross	$107,572	$102,627
Net after taxes	44,543	49,440
Surplus after charges	29,580	34,943
Twelve months gross	1,259,545	1,202,320
Net after taxes	531,956	531,166
Surplus after charges	355,266	353,994

LEWISTON, AUGUSTA & WATERVILLE STREET RAILWAY.

	1913	1912
May gross	$ 54,957	$ 49,814
Net after taxes	21,549	18,671
Surplus after charges	6,056	4,224
Twelve months gross	646,616	613,772
Net after taxes	251,318	230,917
Surplus after charges	76,764	58,640

PORTLAND RAILWAY COMPANY.

	1913	1912
May gross	$ 79,691	$ 77,570
Net after taxes	18,392	22,103
Surplus after charges	7,663	11,897
Twelve months gross	1,003,694	968,160
Net after taxes	295,259	243,203
Surplus after charges	171,264	127,267

Monthly Earnings' Statements.

DETROIT EDISON.

	1913	1912
June gross	$ 408,622	$ 301,296
Net	154,953	117,598
Surplus after charges and depreciation	62,721	26,163
Six months' gross	2,701,474	2,120,065
Net	1,166,514	910,977
Surplus after charges and depreciation	581,552	338,990

LOUISVILLE RAILWAY.

	1913	1912
June gross	$ 275,743	$ 270,067
Net	108,117	112,472
Surplus after charges	58,622	73,883
Six months' gross	1,584,880	1,526,663
Net	689,106	655,638

BRAZIL RAILWAY.

	1913	1912
May gross	£ 225,534	£ 206,715
Net	79,067	98,726
Five months gross	1,136,467	1,092,007
Net	448,867	504,600

MEXICO TRAMWAYS.

	1913	1912
June gross	$ 588,780	$ 558,355
Net	313,643	295,928
Six months' gross	3,265,540	3,271,421
Net	1,722,554	1,751,051

NEW PUBLICATIONS.

MINE SWITCHES.—The Bureau of Mines, Washington, D. C., has issued Technical Paper No. 44, entitled "Safety Electric Switches for Mines," by H. H. Clark. This describes two types of switches and gives the results of tests made upon a number of switches of these types. The tests demonstrate the possibility of constructing an explosion-proof switch that will not ignite gas.

THE REASON OF THE JOVIAN ORDER.—The Jovian Order has published a booklet entitled "The Reason." This is available for members and prospective members of the Jovian Order, and a perusal will indicate the great progress being made by the Order, and win for it increased co-operation and support. In addition to the general information contained in the booklet there will be found a complete draft of the Jovian constitution and by-laws as adopted at the annual meeting at Pittsburgh, in October, 1912.

PERSONAL MENTION.

GEORGE N. KELLEY has been appointed secretary and salesdirector of the Baker Motor Vehicle Company, Cleveland, O.

FREDERICK W. WHITRIDGE, president of the Third Avenue Railway, left for Europe on July 22, on his annual vacation. He will be gone until October.

GEORGE W. GOETHALS, chairman of the Isthmian Canal Commission and chief engineer of the Panama Canal, has consented to accept the honorary presidency of the International Engineering Congress of 1915 and will preside in person over the general sessions to be held in San Francisco, September 20 to 25, 1915.

FRANK E. COLE, for nine years superintendent of the traction lines of the Louisville Northern Railway & Lighting Company and the Louisville & Southern Indiana Traction Company, and for 10 years before that with the Chicago Edison electrical properties, has resigned, effective in 90 days. His position will be abolished after that time, and direct reports made by minor officials to the office of the Middle States Utilities Company in Indianapolis. This company controls the properties referred to.

P. N. NUNN, a director in the Telluride Electric Company of Colorado and Utah, and a resident of New York, is passing some time in Los Angeles and is registered at the Westminster.

J. McMILLAN, general manager of the Pacific Electric Railway system, is erecting three attractive homes of the Swiss chalet type on a beautiful plot of ground in North Glendale. Mr. McMillan will occupy one of these homes, while the other two will be occupied by his sons-in-law, P. Borden Johnson, a Los Angeles automobile dealer, and W. W. Stone, a teller at the First National bank of Los Angeles. Mr. McMillan's property has a frontage of 330 feet on Mountain Avenue and extends back 1,000 feet. The houses will be set back 270 feet from the front of the property. The home for the owner will be of 12 rooms; the Johnson residence will be of nine rooms, while the bungalow for Mr. and Mrs. Stone will contain six rooms. All three houses will have tile baths, large fireplaces and other features. In the landscaping of the grounds two terraces will be created across the fronts and an elaborate system of walks and drives will be laid out. The aggregate cost of the buildings will be something like $25,000.

OBITUARY.

MRS. ALPHA GERALD BROOKS, wife of BELVIDERE BROOKS, vice-president and general manager of the Western Union Telegraph Company, died on July 25 at her residence, 375 West End Avenue, New York. She arrived at her home only a few hours before after journeying from Denver, Colo., where she was stricken on last Saturday while on a tour with her husband. Mr. Brooks immediately chartered a private car, and, accompanied by a doctor and trained nurses, Mrs. Brooks was brought to New York. Mrs. Brooks was 47 years old. Last month she and her husband celebrated the thirtieth anniversary of their wedding. They were married in Waco, Tex., when Mr. Brooks was working as an operator. Mrs. Brooks was the mother of four sons, Gerald, Belvidere, Jr., Bruce and Joseph W.

NEW INCORPORATIONS.

MINNEAPOLIS, MINN.—The Novelty Electric Manufacturing Company has been incorporated by Carl Jaeger, Paul Weigel and Sam. J. Levy, all of Minneapolis. C.

WICHITA FALLS, TEX.—The United Fuel & Power Company has been organized here with a capital stock of $30,000. The incorporators are J. W. Dyson, Andrew Urban and C. E. Menzie, of this city. D.

CHICAGO, ILL.—John V. Cronk Company has been incorporated with a capital stock of $5,000 to deal in electrical supplies and engage in the electrical contracting business. The incorporators are John V. Cronk, E. L. Kramer and George Meyer.

NEW YORK, N. Y.—Monmouth Electric Company, Incorporated, has been granted articles of incorporation to deal in electrical goods, etc. The capital stock is $10,000 and the incorporators are C. H. Hopper, M. H. Hopper and C. Meyer, all of New York City.

NEW YORK, N. Y.—Star Fuse Company, Incorporated, has been granted articles of incorporation to deal in electrical tools and supplies. The capital stock is $1,000 and the incorporators are Louis H. Robinson, New York City; Frederick Simmonds and Nicholas Komow, of Brooklyn, N. Y.

NEW YORK, N. Y.—Beacon Miniature Electric Company, Incorporated, has been granted articles of incorporation to manufacture and deal in electrical supplies. The capital stock is $25,000 and the incorporators are Bernard Tauber, New York City, and Leon Cooper and Abraham I. Wolf, Brooklyn, N. Y.

BINGHAMPTON, N. Y.—Flush Plate & Appliance Company, Incorporated, has been granted articles of incorporation with a capital stock of $3,000 for the purpose of manufacturing and dealing in electrical appliances. The incorporators are Edna L. Gage, George C. Lee and Herman M. Underwood, all of Binghampton.

POUGHKEEPSIE, N. Y.—Wright Storage Battery Company, Incorporated, has been granted articles of incorporation to manufacture and deal in storage batteries. The capital stock is $100,000 and the incorporators are Ralph H. Raphael, Marie F. Wainwright and Rene H. Hammond, all of New York City.

BROOKLYN, N. Y.—Guide Fire Alarm Contracting Corporation has been incorporated with a capital stock of $5,000 for the purpose of installing fire alarms and electrical fixtures. The incorporators are Samuel Shapiro, Mahlon Lewry, of Brooklyn, and John D. Armstrong, of Richmond Hill.

NEW YORK, N. Y.—H. S. Caldwell & Company, Incorporated, has been granted articles of incorporation to manufacture and deal in electrical supplies. The capital stock is $5,000 and the incoroprators are George R. Coote, Brooklyn, N. Y.; H. S. Caldwell, Summit, N. J.; and William V. D. Newbegin, New York, New York.

DATES AHEAD.

Electrical Contractors' Association of Wisconsin. Meeting on board steamer *Georgia*, sailing from Milwaukee to Sault Ste. Marie and return, August 7-12.

California State Association of Electrical Contractors. Fourth annual convention, Santa Barbara, Cal., August 13-16.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach, Mich., August 19-21.

International Association of Municipal Electricians. Annual meeting, Watertown, N. Y., August 19-22.

Old-Time Telegraphers and Historical Association and Society of the United States Military Telegraph Corps. Annual reunion, Detroit, Mich., August 26-28.

American Electrotherapeutic Association. Annual meeting, New York, N. Y., September 2-4.

National Electrical Supply Jobbers' Association. Fall meeting, Clifton Hotel, Niagara Falls, Canada, September 8-10.

Association of Edison Illuminating Companies. Annual convention, Cooperstown, N. Y., September 8-11.

American Electrochemical Society. Semi-annual meeting, Denver, Colo., September 9-11.

American Institute of Electrical Engineers. Pacific Coast convention, Vancouver, B. C., September 9-11.

Northwest Electric Light and Power Association. Annual convention, Seattle, Wash., September 10-12.

Pennsylvania Section, National Electric Light Association. Annual convention, Delaware Water Gap, Pa., September 16-18.

New England Section of the National Electric Light Association. Annual convention, Hotel Vermont, Burlington, Vt., September 17-19.

Illiuminating Engineering Society. Annual convention, Pittsburgh, Pa., September 22-26.

Association of Iron and Steel Electrical Engineers. Annual meeting, New York, N. Y., September 22-27.

Colorado Electrical and Industrial Exposition, Auditorium, Denver, Colo., October 4-11.

Colorado Electric Light, Power and Railway Association. Eleventh annual convention, Denver, Colo., October 6.

Jovian Order. Annual convention, Hotel Astor, New York, N. Y., October 14-16.

Telephone Pioneers of America. Annual meeting, Chicago, Ill., October 13-17.

Electrical Exposition and Motor Show of 1913. New Grand Central Palace, New York, N. Y., October 15-25.

Association of Railway Electrical Engineers. Annual convention, Hotel La Salle, Chicago, Ill., October 18-24.

Electric Vehicle Association of America. Annual convention, Hotel La Salle, Chicago, Ill., October 27-28.

With the Electrical Manufacturers

Oxford Telephone Manufacturing Company, Fayetteville, Ark., plans the establishment of a factory for the manufacture of dry-cell batteries, crossarms and other equipment for telephone use. Machinery is to be purchased at once.

Line Material Company, South Milwaukee, Wis., is sending out a series of four folders, calling attention to the merits of "The Kyle Line" malleable-iron bracket, pole-line hardware and construction material, arc-lamp insulators and hangers, and the Hendee flexible insulator bracket.

H. W. Johns-Manville Company, New York City, has issued a folder briefly describing the advantages of the Frink and J. M. Linolite systems of illumination for central station and telephone switchboards. As might be implied from the foregoing the equipment includes Frink reflectors and Linolite tubular lamps.

Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, Ill., has sent out discount and price list No. 116 applying to the Belden catalog No. 5. This gives the base price and discount for the great variety of bare and insulated copper and iron wires that this company manufacturers. Reference is also made to prices on solder, soldering compounds, tapes, sleeving, etc.

The Sanax Company, 125 East Twenty-third Street, New York, N. Y., has some interesting literature prepared describing and illustrating the "Foen," which is an electric hot and cold-air producer. The "Foen" is highly efficient, reliable, handy, neat, and of light weight. It produces a very strong current of air which may be hot or cold immediately after connection, as the circumstances may require.

Allegemeine Elektricitats-Gasellschaft, Berlin, Germany, has issued a bulletin describing its direct-current dynamos and motors of the type HN. The motors in this class are of various sizes from 0.1 to 8 horsepower, and the generators range in sizes from 0.17 to 6.5 kilowatts. These machines are normally shunt machines, but can be also provided with compound windings. They are well ventilated and of rugged construction.

The Manhattan Electrical Supply Company, New York, N. Y., has purchased the business and plant of the Rock Island Battery Company, of Cincinnati, O., and will take possession on August 1. This important move will not mean the discontinuance of the Rock Island dry battery, for this bat-

tery will be manufactured in addition to the Red Seal, Hi-Up, Blue Seal and Mesco batteries, now manufactured by the Manhattan Electrical Supply Company.

Franklin Electric Manufacturing Company, Hartford, Conn., has purchased three of the buildings which formerly comprised the plant of the Leeds & Catlin Company, manufacturer of phonograph records at Middletown, Conn., and after extensive improvements and additions have been completed, will occupy the plant probably about January 1, next. It is understood that the company's Pittsburgh and Newark plants will then be abandoned.

Charles W. Gremple, 125 Fifth Avenue, New York City, is sending out cards with brief description of what has been designated as the "efficient drifting kit." This is a portable and self-contained outfit including a composition drawing board, spring clip, T-square and two triangles, all inclosed in a telescope carrying case. This makes a very handy set for making preliminary sketches, charts, curves, layouts, diagrams, etc., and that can be used for making drawings on sheets as large as 11 by 15 inches.

Hemingray Glass Company, Covington, Ky., has recently issued catalog No. 28. The company has been the manufacturer of Hemingray standard glass insulators continuously since 1863, and this catalog is a credit both in arrangement and finished appearance to the experience and age of the company. The catalog covers the entire line of Hemingray insulators, a perspective and sectional drawing illustrating each type of insulator. There is also full information respecting the average weight per piece, the approximate weight per thousand packed, and the standard package quantity, and the line voltage with the dry and wet-test overvoltages.

Reynolds Electric Flasher Manufacturing Company, 617 West Jackson Boulevard, Chicago, Ill., is now supplying colored-glass lamp hoods to fit all sizes of lamps up to 16-candlepower carbon-filament lamps and 40-watt Mazda lamps. These hoods were described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, of November 9, 1912, and when first put upon the market were of sizes to fit sign lamps only. The hoods are supplied in six colors and slip easily over the lamp bulb, and have several advantages over the use of lamps with colored bulbs. They are used extensively in electric signs, on elevator signals, exit lights and for many decorative purposes.

National Tube Company, Pittsburgh, Pa., announces that commencing August 1, it will enter the electrical conduit field. This company has contracted with the National Metal Molding Company and the Safety-Armorite Conduit Company, both of Pittsburgh, Pa., to manufacture and sell this product for it as its agents under their various brands. The National Tube Company has also decided to sell this product on the "Pittsburgh Basing Discount" plan in the same manner as wrought pipe for other purposes has been sold for the past 13 years.

H. M. Byllesby & Company, Insurance Exchange Building, Chicago, has published for its department of examinations and reports, a handsome folder devoted to "The Efficiency Movement." This is designated as Department Bulletin No. 6. Few engineering organizations have had a better or wider opportunity to study the principles of profitable utility operation and to assimilate, classify and develop successful efficiency practice than the department of examinations and reports of H. M. Byllesby & Company. The compilation of innumerable data and their painstaking analysis, have placed the department in possession of organized knowledge of an entirely practical character. While all efficiency study should be based upon a reliable appraisal of the property, the department is prepared to examine and analyze any of the various phases of the industry, to suggest improvements, and if need be, to organize and install the requisite systems, departments and methods. In all this work, the department has at its service the engineering organization of H. M. Byllesby & Company; technical, commercial and legal libraries; the legal, accounting and securities divisions and the operating division, which is continuously engaged with operating conditions and which includes sales, publicity and insurance experts.

Record of Electrical Patents.

Issued by the United States Patent Office, July 22, 1913.

1,067,813. Vacuum Cleaner. H. H. Harrold, assignor to Wise-Harrold Electric Co., New Philadelphia, O. Includes a motor-driven suction pump.

1,067,823. Resonating Relay. H. von Kramer and G. Kapp, Birmingham, England. A contact device including a reed actuated by feeble alternating currents.

1,067,845. Apparatus for Mixing Beverages. B. E. Shattuck, assignor to A. P. Williams, West Upton, Mass. Pressing down on a telescopic post closes the motor circuit. (See cut.)

1,067,851. Means for Producing Roentgen Rays. A. Wasmus, assignor to Gesellschaft für Drahtlose Telegraphie, M. B. H., Berlin, Germany. Includes a high-frequency transformer, a spark gap, a quench tube and a Roentgen tube.

1,067,860. Shaft Bearing. W. M. Bradshaw, assignor to Westinghouse Electric & Mfg. Co. The lower meter bearing includes a spring-supported jewel; the upper guide bearing is rotatable.

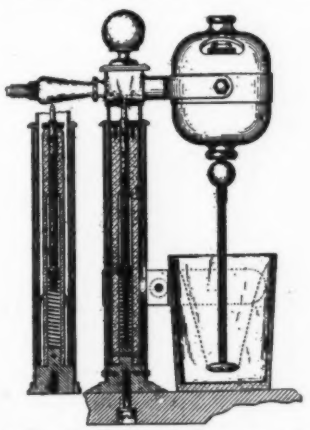
1,067,864. End-Play Device. G. W. Christians, assignor to T. E. Murray, New York, N. Y. Electromagnetic shaft-reciprocator for a rotary converter.

1,067,866. Fuse-Plug. F. G. Craig, Jr., Highland Park, Mich. An Edison screw plug with two fuse wires.

1,067,869. Electric Heating Unit. B. Falkenberg, assignor to Pacific Electric Heating Co., Ontario, Cal. For disk stove; has a resistance clamped between a retaining plate and the outer plate.

1,067,880. Resistance Inclosure. C. A. Rhine and C. H. Keeney, Milwaukee, Wis. Ventilated and flameproof rheostat for motor starter.

1,067,899. Electric Lamp-Positioning and Removing Device. A. O. Craig, Seattle, Wash., assignor of one-half to E. Levy. Has a rotatable and angularly adjustable head with a lamp grip.



1,067,845.—Motor-Driven Beverage Mixer.

1,067,903. Valve Mechanism for Pump Suction Pipes. T. Elliott, Seattle, Wash., assignor of one-third each to S. D. Crockett and H. J. Armstrong. A motor-driven pump with solenoid-operated valves energized simultaneously with the motor.

1,067,903. Calorimetric Bomb. C. Féry, Paris, France. Includes a fine iron wire for electrically igniting the charge and a thermocouple to measure the calorific value of the charge.

1,067,909. Trap. G. W. K. Fisher, Vancouver, Wash. Includes an electromagnetically controlled trap-door.

1,067,936. Electric Switch. H. R. Mitchell, North Yakima, Wash. A bolt-controlled door switch.

1,067,951. Covering for Electric Conductors and Method of Preparing the Same. E. T. Trotter, Brooklyn, N. Y. A waterproof and flame-resisting coating comprising five parts of stearin pitch and on part of manganese oxide.

1,067,972. Means for Automatically Weighing Material on Conveyor Belts. H. Comstock, Mineville, N. Y. An electric weighing apparatus includes a wattmeter serving as a weight indicator and having one coil excited by a magneto whose speed varies as that of the belt, and the other coil by a current which varies as the rise and fall of the belt.

1,067,974 Method of Discharge of Electricity into Gases. F. G. Cottrell, assignor to International Precipitation Co., Los Angeles, Cal. Consists in exposing to the gas a surface facilitating a non-disruptive discharge and applying a negative potential approximating the disrupting potential.

1,067,995. Electric Dynamometer. F. Lux, Ludwigshafen-on-the-Rhine, Germany. Includes a shaft with a concentric ring, a polarized electro-motor, two batteries, an induction coil and a spark gap.

1,068,010. Sostenuto Device for Musical Instruments. M. L. Severy, Arlington Heights, and G. B. Sinclair, Winthrop, Mass. Includes electric control.

1,068,023. Railway-Train-Control Apparatus. J. T. Thompson, assignor to Thompson Automatic Signal Co., Chicago, Ill. An electric control equipment on the locomotive co-operative with track circuits.

1,068,024. Signal or Control Mechanism for Railway Trains. J. T. Thompson, assignor to Thompson Automatic Signal Co. A modification of the above.

1,068,064. Apparatus for Moistening, Deodorizing, Disinfecting, Perfuming, and Cooling Air. F. Lesser and A. H. Avery, New York, N. Y., assignors to Spray Ozone Co. Includes a motor-driven fan.

1,068,065. Heating Apparatus. G. F. Machlet, Jr., Elizabeth, N. J. Includes a galvanometer for electrically regulating a furnace.

1,068,076. Receiver for Electromechanical Telegraph Systems. W. K. Queen and T. F. Pickett, Needham Heights, Mass. A visual signal apparatus including a rotary signal drum and signal-selecting magnets.

1,068,082. Danger Signal. J. H. Sanor, Canton, O. Includes sectionalized track circuits and spring contacts along the rails.

1,068,088. Portable Electric Lamp. F. C. Smith, assignor to Waterbury Mfg. Co., Waterbury, Conn. Contains a battery, lamp, reflector and switch.

1,068,110. Flying Machine. N. B. Converse, Fresno, Cal. Includes a generator and electromagnetic clutches for plane-adjusting shafts.

1,068,111. Shaft Revolution Indicator System. J. J. Crain, Quincy, Mass. The shaft drives a three-phase generator that supplies current to the indicator motor.

1,068,119. Electric Signaling Device for Moving-Picture Rewinding Mechanisms. C. V. Foote, Nephi, Utah. A contact engages the film so that a break in it closes an alarm circuit.

1,068,122. Automatically Controlled Pump. P. F. Goehring, Guttenberg, N. J. A motor-driven pump with pressure-controlled contact in the motor circuit.

1,068,131. Bowling Alley. H. V. C. Holland and W. H. Wiggins, Brooklyn, N. Y. A motor-controlled elevator to raise the balls from the pit to the return runway.

1,068,132. Speed-Controlled Device and Indicator. M. R. Hutchison, assignor to Industrial Instrument Co., Waterbury, Conn. The shaft drives a magneto which supplies current to a voltmeter through an automatic reversing switch. (See cut.)

1,068,133. Speed Device and Indicator. M. R. Hutchison, Summit, N. J. Similar to the above, but the voltmeter is cut out on reversal.

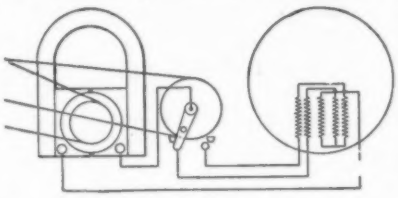
1,068,134 to 1,068,136. Speed Device and Indicator. M. R. Hutchison, assignor to Industrial Instrument Co. Further modifications in which more than one generator and voltmeter are used.

1,068,144. Switch Rod. H. A. Lawler and C. A. Lawler, Horton, Kans. The two ends of the rod are insulated from each other.

1,068,148. Electrode Holder for Electric Furnaces. D. A. Lyon and E. R. Cox, Jr., Heroult, Cal. Comprises a casing with an internal clamp for the electrode, and an external clamp for securing the casing to its support.

1,068,152. Dynamo-Electric Machine, Particularly Applicable for Ignition Purposes in Connection with Internal-Combustion Engines. A. H. Midgley and C. A. Vandervell, Acton Vale, England. A direct-current generator adapted to give constant voltage at variable speed.

1,068,192. Case for Incandescent Electric Lamp Sockets. A. Weber, Sr., and J. Weber, assignors to Weber Electric Co., Schenectady, N. Y. The cap and shell engage through a serrated flange.



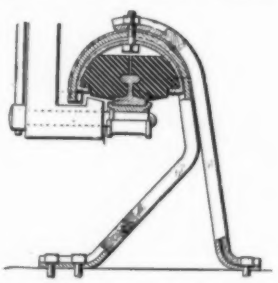
1,062,132.—Speed Indicator.

1,068,216. Automatic Heat Regulator. A. P. Broomell, York, Pa. A solenoid-controlled thermostat.

1,068,217. Automatic Piano-Player Having Self-Setting Device. K. O. Carlson, assignor to National Piano Mfg. Co., Chicago, Ill. Includes a motor-driven pump and automatically rotatable music-roll carrier.

1,068,220. Means for Producing Sound Waves. L. E. Côté, Ottawa, Ont., and W. F. Kelley, Halifax, N. S., Can. An electric igniter explodes gas at a frequency corresponding to that of the resonant chamber.

1,068,233. Third-Rail Support or Chair. J. S. Fox, Jackson, Mich. For an inverted rail. (See cut.)



1,068,233.—Inverted-Third-Rail Support.

1,068,253. Spelling Mail Indicator. C. H. Luther, Fayetteville, Ark. An electromagnet releases a letter.

1,068,255. Signaling Device. M. J. Mandelbaum, New York, N. Y. A turnout vehicle signal in the form of a pointing sign with electric lamps and alarm.

1,068,322. Heater. L. E. Church and J. A. Cooney, Bartlesville, Okla. Superposed layers of resistance wire are arranged in a circular opening.

1,068,331. Electric Lamp. H. A. Douglas, Chicago, Ill. Has a cylindrical plunger socket with bayonet contacts.

1,068,335. Brush-Holder for Dynamo-Electric Generators or Electric Motors. J. E. Grant, assignor to Morgan Crucible Co., London, England. A C-shaped spring holds jaws so as to clamp a flexible conductor.

1,068,341. Fusible Cutout for Controlling Electric Circuits. V. Hope, Manchester, England. A fuse consisting of a core of copper and a sheath of tin-lead alloy.

1,068,343. Electrically Heated Glue Pot. A. C. Hulbert, San Francisco, Cal. A jacketed pot with switch controlled by pressure of steam in the jacket.

1,068,370. Illuminating Device for Photographic Recording Apparatus. F. Simpson, Liverpool, and A. R. T. Woods, London, England. A narrow cell with an electric light located at the focus of the parabolic reflector.

1,068,387. Electric Signaling. F. B. Herzog, New York, N. Y.; H. Herzog, executrix of said F. B. Herzog, deceased. A single-line system with a number of transmitting stations has the latter arranged so that characteristic signals from each will be received successively without confusion.

1,068,388. Apparatus for Cleaning Gold, Silver and Other Metal Ware. J. M. Hotchkiss, Burlington, Vt. A shallow zinc tray has in it a rack formed of parallel copper bars connected to the tray, and an electrolyte consisting of salt solution.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 28, 1913.

564,629. Electrical Propulsion of Canal-Boats. A. C. Mather, Chicago, Ill.

564,632. Electric-Car Brake. A. W. Mitchell, Winthrop, Mass.

564,652. Paste-Carrying Plate for Electric Accumulators. F. W. Schneider, Triberg, Germany.

564,679. Back Connection for Switchboards. J. Wurts, Pittsburgh, Pa.

564,683. Electric Railway. W. Daves, Jersey City, N. J.

564,702 and 564,703. Alternating-Current Generator. B. G. Lamme, Pittsburgh, Pa.

564,706. Signaling Apparatus. P. Lüpke, Trenton, N. J.

564,717. Electrical Soap. H. E. Rider, New York, N. Y.

564,723. Incandescent-Electric-Lamp Fitting. E. F. A. Soleau, Paris, France.

564,743. Dynamo-Electric Machine and Electric Motor. W. B. Elliott and W. Eskholme, Westfield, N. J.

564,745. Telephone System. C. C. Gould, Philadelphia, Pa.

564,746. Annunciator. C. C. Gould, Buffalo, N. Y.

564,771 and 564,772. Electric Arc Lamp. W. C. Armstrong, New York, N. Y.

564,792. Electric Metal-Working Apparatus. H. Lemp, Lynn, Mass.

564,811. Secondary Electric Clock. J. H. Wilson, Rockwood, Tenn.

546,858 and 564,859. Electric Metal-Separator. H. H. Whitacre and A. C. Wolfe, Wellsville, O.

564,861. Electric Rack Locomotive. D. L. Barnes, Chicago, Ill.

564,902. Electric-Motor Support. S. H. Short, Cleveland, O.

564,907. Electric Arc Lamp. B. B. Ward, New York, N. Y.

564,926. Sound-Locating Instrument. D. P. Heap, U. S. Army.

564,944. Electric Transformer. F. L. Sessions, Fort Wayne, Ind.

564,951. Electric-Current Regulator and Distributer. A. H. Washburn, Brockton, Mass.

564,952. Incandescent Lamp. H. Zerning, Berlin, Germany.

Electric Vehicle Section

Electrical Automobiles from the British Point of View.

The central-station men of Great Britain are awakening to the possibilities of the electric vehicle as a profitable source of revenue. At the recent meeting of the Incorporated Municipal Electrical Association, at London, England, a paper entitled "Electric Automobiles," by W. H. L. Watson and R. J. Mitchell attracted a great deal of attention and presented some interesting features which are worthy of reproduction here.

Electric Automobiles.

The Electric Vehicle Association of America has now several branches in active operation, including one in Chicago and several pending in New England. This remarkably active association is a tremendously powerful ally to the industry, and advertises on a large scale, having spent $100,000 already in publicity anent the electric vehicle. A large proportion of this fund was subscribed by electric power companies, whose principals were alive to the importance of the charging load awaiting their stations. The association holds monthly meetings, at which papers are read on the more interesting aspects of the industry. Such contributions include not only scientific papers of the type of A. Churchward's essays on road resistance and the like, but also contributions of a purely commercial tone. All of which means that the association is no academic body of merely philosophical enthusiasts, but rather an energetically determined body of men bent on pushing, and, moreover, forcing, the electric into the front rank position they consider it should hold. British engineers might well copy America here, bearing in mind that, just as soon as production exceeds demand, American manufacturers may start plans for an electric vehicle crusade in Great Britain. As a matter of fact, such a crusade would present fewer difficulties in this country than it must have met with in America. Roads are admittedly much better in Great Britain than in the States, labor costs are about half, whilst here electrical energy is far cheaper. In view of these facts, the authors wish to express earnestly the sincere hope that British engineers and manufacturers will not allow the splendid opportunity which lies near to escape their observation merely because a few pessimists think "there's nothing in it." It is felt that no time was ever more opportune than now for a thorough discussion of the problems involved in the organization of a British electric-vehicle industry. Power at a low price is a *sine qua non* for a really successful "electric" movement to become an actuality in Great Britain. Central-station men are, therefore, interested most intimately in the new industry, which will be not only a branch of the motor-car business, but equally an expansion of the electric-supply engineer's field of activities. This applies practically to every supply station in Great Britain.

A survey of the electric-vehicle field reveals the existence of more than 130 separate models now available on the American market. Of these, about half are pleasure automobiles. Confining attention for the present to industrial vehicles, it is noticeable that this range of cars includes parcel vans of 500 pounds capacity at one end and coal trucks carrying 10,000 pounds at the other end of the list, with vehicles of graduated loadings above and below the limits stated. It needs no comment or explanation for any business man to see that cheap ton-mileage depends on employing fairly heavy trucks. This economical feature is, of course, not alone applicable to electric vehicles, a somewhat similar condition obtains with petrol machines, though nothing like so decidedly. American practice inclines to the two or three tonner for heavy haulage, using the lighter types of vehicles for services where very cheap ton-mileage is of no account. For an extreme example the drapery business suffices. In such a case a very light car would be economical; and, in fact, all despatches of numerous packages of value can be most economically dealt with by the lighter vehicle. Heavy stuffs, such as coal, cement, bricks and the like, demand a truck big enough to deal with large quantities in one haul. Some reference to speed is desirable at this point. The casual critic seeks generally to damn the electric by accusing the whole class of vehicles with deficient speed and inability to climb hills. Neither of these defects exists in practice, though the electric does not claim the speed of its far more highly rated petrol competitor. Speed is purely a question of battery power and motor rating; and as commercial aspects towards engineering demand always a compromise, it is found the most economical to make the commercial electric a modern speed vehicle able to maintain a uniform speed for a reasonable distance, this latter varying from 35 to 75 miles per single charge, according to circumstances. Moderate and uniform speed means greatly decreased wear and tear on all parts of the chassis and transmission, including tires, which are usually guaranteed an extra 20 per cent in mileage for use on battery cars.

Successful vehicle service entails batteries of the lightest possible construction consistent with durability and high specific energy output per pound. In the earlier days plates of the pasted type were employed mounted in an open containing case of ebonite. The output of such batteries hardly exceeded six watt-hours per pound, and was sometimes less, whilst their life was a little over 100 complete cycles of charge and discharge. Considering that in the year 1900 a 44-cell battery of 130 ampere-hours nominal capacity costs about $500, there is little wonder that electric automobile progress languished, at all events in England. The defects of early accumulators are so well known that any further mention of them is uninteresting. Beyond stating, therefore, that storage batteries appear to have proved what a chasm can separate ideal theory from even moderately good practical attainment, nothing more needs to be said. The vanished companies for battery car exploitation bear witness to some of the failures of the past. Lest it be assumed that the lead-sulphuric accumulator is still in its original elementary state of crudity, let it be understood at once that quite the contrary is true. The modern electric-vehicle accumulator, as developed largely by American engineers, is a triumph over mechanical and chemical disabilities which can only be paralleled in the early troubles of carbon glow-lamp manufacture. Improvements have become effected, not by any radical departure in design or revolutionary discovery, but rather because there has been applied every available bit of knowledge that could coax such

unsatisfactory metal as lead into performing its dual function of resisting stress, yet giving sufficient surface for efficient energy output without undue weight.

For practical service there are but two types of storage battery in present-day usage. These are the lead sulphuric acid cell, developed mechanically to a high perfection considering the great difficulties of so doing, and the nickel-iron alkali cell, of which the Edison is the best-known example. As matters stand, the modern vehicle battery is a compromise between lightness and durability. The usual plan is to make positive plates a little over one-eighth inch thick and negatives somewhat thinner. The pasted type of plate finds most favor, though in some cases a specially light Planté plate has given good results, in spite of the greater weight entailed, a longer life making a small concession in weight more than justified. Spacing is arranged to be a minimum that considerations of electrolyte volume permit, whilst the specific gravity of the electrolyte is sometimes as high as 1.3. Separators of perforated sheet ebonite are often employed, fully encasing the positive plate in some instances. American practice also favors separators of specially impregnated thin wood sheets, these having proved cheaper than ebonite and equally effective. Considered as a mechanical job, the lead battery for automobiles has improved immensely. In place of the anciently used open container, a sealed-in case is nowadays employed, the top being liquid-tight yet removable.

The actual life figures for any condition of service seems to be dependent largely on circumstances. Thus there are some well-vouched-for instances where accumulators have given 6,000 or 7,000 miles of running before becoming too much reduced in capacity for further economical service. On an average, it would apparently be true to assign a life of 3,000 or 4,000 miles to a lead sulphuric battery in automobile service. A prominent English company running a fleet of private cars in London reckons usually to get 3,000 miles' life from positive plates, whilst negatives last sometimes as long as 6,000 miles. In this example the conditions are rather exacting, as it is a common occurrence for the current demand to equal a one-hour discharge rating. The modern lead battery is remarkably compact, and in average cases can store a watt-hour for every cubic inch of the space occupied. This means that two horse-power-hours can be delivered at the road wheels for each cubic foot of battery, weighing on an average from 180 pounds to 200 pounds. In emergency, the lead battery will give a surprising power output for short periods. On a recent test of an 'Exide battery, a momentary discharge rate equal to 75 horsepower was obtained from a battery weighing only 1,500 pounds.

Very prolonged tests indicate that the Edison A type battery, the type that has now been going since 1908, possesses some unique features chief of which are its nearly perfect immunity from the effects of mechanical abuse, the fact that no troubles, such as a plate buckling nor shedding of active material, can occur, and the absence of injury due to severe overcharging or discharging both as to duration and degree.

At first sight there would appear to be no reasons why an electric should not be controlled by variations of voltage obtained by grouping the battery in successive arrangements of increasing voltage. This could apparently be done quite simply by dividing, say, a 60-cell battery into some series, so that four voltages become available for speed control. Enticing as such a system appears, it yet proves to be rather complicated in practice, due to the large number of leads involved and the somewhat heavy currents which must be broken on the controller. Moreover, the last step is somewhat of a jump compared with previous graduations, being inevitably 100 per cent increase over immediately previous voltage conditions. This would entail rather jerky running when changing from speed (3) to (4). Further objections to the pure series-parallel system of control lie in the effect of discharging batteries of the lead type in parallel, resulting in harmful inequalities of discharge towards the end of the output. With a lead battery this treatment may cause injurious sulphating, and not a uniform behavior of the cells as a whole. The objection, however, has no weight in the case of nickel-iron cells of the Edison type, as these cells are quite unaffected by arduous discharge conditions amounting to short-circuiting on the one-hand, or being left on open circuit for indefinite periods. From the efficiency standpoint the series-parallel method of control is much in advance of the systems using resistances which have displaced it, and future practice might reinstate the system with considerable advantage if mechanical difficulties be overcome. Modern vehicle motor controllers are mostly of the continuous-torque drum type, operated by a lever, geared up in its effect by meshing with a small spur pinion on the drum shaft. Usually a series of five or six speeds is provided, the highest being that obtainable with full battery voltage across the motor together with a field partially shunted by a resistance of the iron-grid type. With a few exceptions, the springiness of the contact fingers is relied upon to give an adequate contact on the drum sectors, the current being broken on the drum itself. This is not the best practice, and could be much improved by arranging to operate a carbon-break switch immediately after a drum contact has been ruptured. Another method, actually used on one car, effects the same result by using a magnetic "blow-out" coil, the field of which "wipes" out injurious arcing. Other refinements include the automatic breaking of the current when putting on the emergency brake, which latter, particularly on commercial vehicles, is interlocked with the controller. Yet another modification employs solenoid contactors of the railway type to operate the controller. This design, provided a very high degree of care be exercised in its installation, should have a considerable vogue in the future. It would be a distinct gain to be able to operate a five-ton truck by push-button electrical control. Electric braking does not appear to find favor in American practice, though one English car, the well known Electromobile, uses such a brake for emergency service. If designed so as to retard the car gently—that is, not to skid the driving wheels—there is much to be said in favor of electric braking, as it is less severe in its action and wears nothing out. A useful refinement to a controller consists in aranging that an electric bell shall ring if the current be left on when the brake is also in the hard-on position. This is more necessary than may appear at sight, as it is quite easy for a careless driver to leave his controller in the first notch (generally insufficient to move the car with the brake on), thus wasting much energy and perhaps doing great damage.

Charging plugs were the occasion of much confusion and waste of time in the earlier days of the American industry. This matter should, in the opinion of the authors, be discussed in England as early as possible by those interested. Much trouble afterwards would be saved by the adoption of a soundly designed plug right from the beginning of the movement. The electric automobile, whether pleasure car or commercial, presents some special problems of its own on the score of lighting equipment. The usual arrangement consists in taking leads from a few cells of the power battery, relying on the gradual voltage drop not proving great enough to dim the lights seriously. In American practice some difficulty is occasioned by the lack of standardization in bulb

The Central Station's Greatest Opportunity

The manufacturers of electric trucks who ask Central Stations to stimulate the use of electrics by utilizing them in their own service first, are looking into the future. They are not wholly selfish. At least they show the Central Station its opportunity and open the way for increased annual output. There is no need of arguing about it, for here's the evidence.

Sales by Central Stations to Merchants

During the month of May, a Central Station which practices what it preaches, **sold an electric truck every three days — direct to merchants in its own city.**

It has sold nearly 50% of its goal of 100 trucks and 100 is by no means the saturation point. Again the last 50 trucks will "come" so much easier than the first 50.

Another Central Station has **inside of 18 months,** sold direct to merchants and manufacturers in its own city, **nearly 90 electric trucks!** The second 90 are in sight with the saturation point still beyond the horizon.

IS Yours a 100 Truck City?

If it has 100,000 people it probably is. Those 100 trucks will mean an active business of 1,000,000 horse power hours annually.

Worth working for, don't you think?

Catalogue 85 and other information on request.

General Vehicle Company, Inc.

General Office and Factory:
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New York **Chicago** **Boston** **Philadelphia**

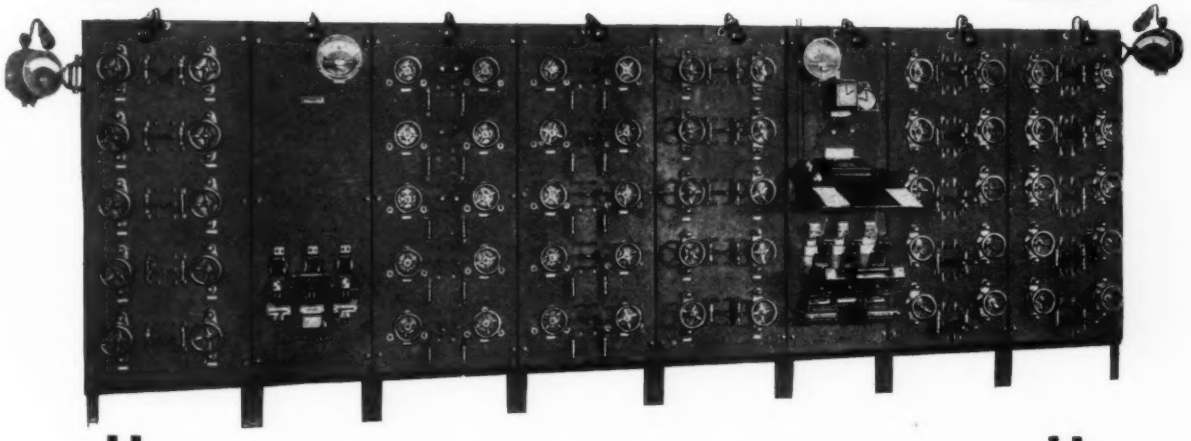
Arnold Constable & Co., Have Used G. V. Electrics Since 1902

sockets; this difficulty would be much smaller in England, however. A voltage of six on metal-filament lamps gives a good range of candle-power in stock bulbs, and such lamps are very cheap. It is a good plan to put the rear lamp in series with a small colored bulb illuminating the ampere-hour meter on the dashboard. Reference should be made here to the use of the ampere-hour meter. This device has attained much perfection and convenience of form mainly at the hands of the Sangamo Electric Company. Such an instrument replaces the ampere meter and voltmeter if used discriminatingly, at the same time affording a more accurate index of the battery performance. In one type, the best in the author's opinion, there is a differentially shunted circuit which insures that ampere-hour reading shall be a true measure of battery output, and shall measure effective battery input, that is allowing for battery efficiency. Thus 85 amperes for one hour would register an output of 85, but to register an input of 75 ampere-hours would probably require 100 ampere-hours. If the instrument be set to allow for necessary inefficiency, it may then be ued practically as a reversible energy meter. This applies especially to the Edison battery, in which it happens that ampere-hour output is hardly affected by rate of discharge. This ampere-hour meter is a damped mercury motor, of which the speed is nearly proportional to the value of the current passing.

The pioneer electrics were as lacking in detail perfection as they have become refined and advanced. For some not very obvious reasons these machines were made disproportionately heavy, and in the case of pleasure cars were equipped with bodies, the great ugliness of which has created a widespread impression that the electric must necessarily be ungainly and archaic in appearance. Although great advances have been made in the attainment of a pleasing appearance in the case of pleasure cars, there yet remains something to be done on the score of proportioning the weight of the car accurately to the demands likely to be made on it. As already mentioned, there is something more than difference of opinion involved when two cars designed for the same duty differ in weight by over a ton. Being essentially a moderate-speed machine, it should be possible to make the electric slightly lighter than its petrol competitor for many services, particularly in the case of the heavy type of passenger machine, including 'buses, char-à-bancs and the like. The somewhat heavy design adopted by American manufacturers may probably be due to the exceedingly bad roads which are met with even in many of the more important cities of the United States. It is likely, therefore, that the excellent roads of the United Kingdom may permit of a considerably lighter type of machine coming into general use here, an advantage being thereby gained in mileage. As is natural, the design of American commercial electrics has been followed in its main features closely on the lines laid down by the petrol car. Frames are usually of pressed-steel channel form, stiffened by cross bracing and gusset plates, the lighters being built up from stock sections. A sub-frame is used to suspend the battery case and also for the motor when this is geared by silent chain to a countershaft. Whilst there is some diversity of practice in both battery location—this applies more particularly to pleasure cars—and to the method of mounting the motor, there is a general unanimity of practice in choosing chain drive as the final transmission for commercial cars. The live axle is but rarely used on commercial electrics, though a tendency is observable in that direction in the latest models.

The most usual position for the battery is amidships and longitudinal, thus permitting of easy access for examination when necessary. In one or two cars the battery is mounted in two trays, one on each side of the chassis, which can be pulled out sideways on castors, the side lid of the battery box serving, when hinged down, as a horizontal platform for this purpose. It is not usual to make provision for unshipping the battery in place of a "freshly charged" renewal. Practice favors rather the method of giving a vehicle a battery adequate to deal with an average day's work. Springs have received much careful attention, and are usually provided with well lubricated shackle bolts having stauffer grease cups to maintain that desirable condition. American designs of steering gear would not strike the British engineer as being sufficiently robust, nor does much attention appear to be given to the possibility of taking up wear on the reduction gear thereof. Irreversible steering, especially on a heavy chassis, entails an unpleasant backlash on the steering wheel unless the steering gear be in a very good adjustment. Another feature of American design lies in the frequent practice of arranging the steering connections in front of the axle. It is not a vital point, though where possible—and three cases are a majority—it would seem better to place the cross rod out of reach of accidental bumps. Exception might also be taken to the inadequate and inaccessible arrangements made for applying an oil can or filling grease cups on some cars. The ball-snap lubricating terminal may be cheap, but it is certainly very inconvenient, especially when situated in some place where the oil-can spout can approach it only horizontally. Mud wings are another improvable detail; these do not encircle the wheels enough, nor sometimes is the front guard provided with an extension flap, the absence of which entails splashing of body work and an absence of the smart appearance associated always with the electric.

The tire problem is one that has not been studied as carefully as it warrants by engineers. Speaking generally, it is assumed that if a wheel be shod with a tire sufficiently large in cross-section to carry its load, whilst possessing also a good degree of resiliency, then, granting durability and freedom from road trouble, no other consideration need be involved. Perhaps such a view of the condition is warranted when specifying tires for a heavy petrol machine, as the large excess of power over average requirements available renders any loss of wheel-to-road efficiency unnoticeable, excepting in the fact that some tires may get unduly hot. With the electric the tire question is a very important one, even more important in many instances than, say, the choice between chain and gear transmission. For heavy machines the chief consideration appears to be not to equip with tires that are very soft. A medium hard tire gives noticeably better mileage, due partly, no doubt, to the lessened internal work performed on the tire. This loss is evidently a function of the depression of the loaded tires as compared with the same tire unloaded. The exact relation between resiliency, speed, load and internal loss are apparently not at present known; though differences in mileage of as much as 50 per cent are stated to have been measured on the same vehicle changing over from one make of tire to another, all other conditions remaining unaltered. Pneumatic tires afford the same type of comparison, similar to the now well known difference existing between the so-called "cord" tire and tires of the canvas type. Carefully made experiments in England have proved that one make of tire absorbs 100 units of energy, whilst another under the same conditions, fritters away 180 units. It will not be surprising, therefore, to learn that some recent experiments on an electric car proved that the ordinary type of pneumatic tire absorbed 25 per cent more power from the battery than the standard make of "special electric" tire. Unfortunately, there appears to be as yet very little



The World's Largest Electric Garage

Will Be Equipped With 120

Allen-Bradley

Battery-Charging Rheostats

It is operated by the Murphy Power Co. of Detroit, consists of 10 floors with a total area of 65,000 square feet, and will house, wash and charge 300 cars without crowding.

Allen-Bradley Rheostats were selected for their compactness and durability and because with them any combination of cells can be charged at exactly the required ampere rate, making it possible to charge in the shortest time and secure the maximum life from the battery.

Every user of storage batteries should have our Bulletin B-40. Ask for your copy now.

Allen-Bradley Co.

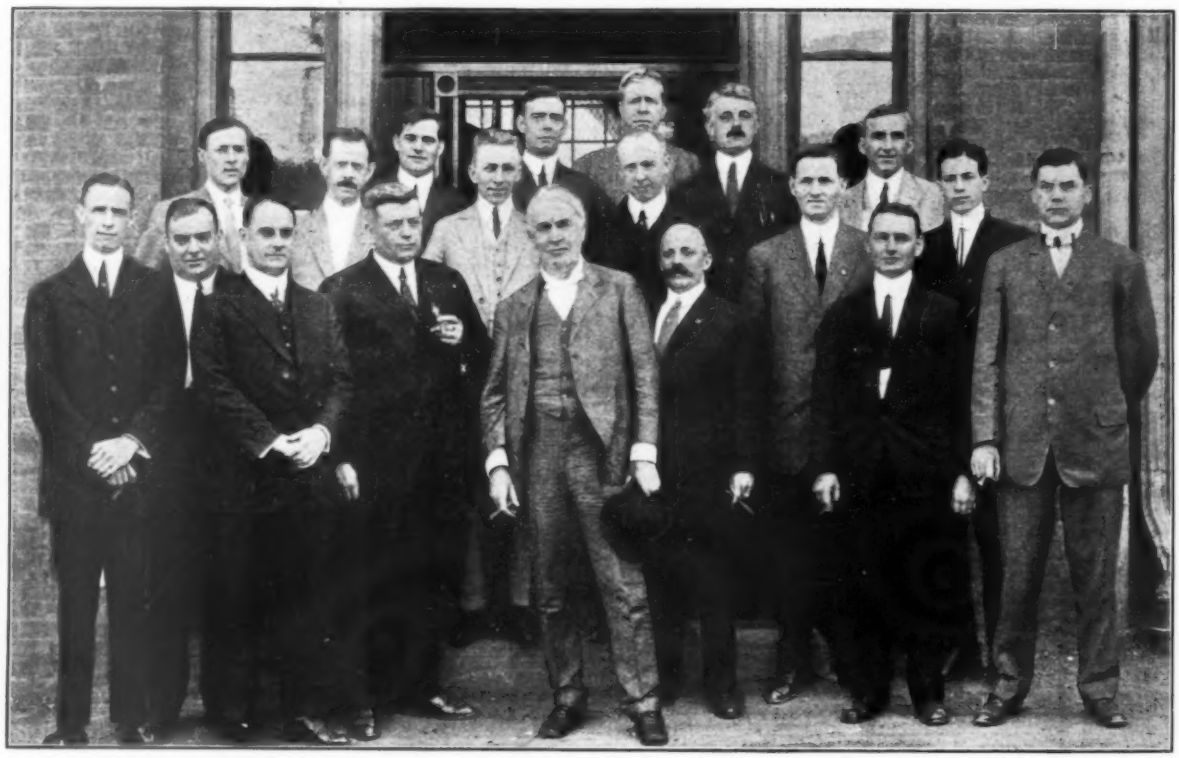
495 Clinton Street Milwaukee, Wis.

information available on this interesting subject. Evidently it is worth studying, however. The special tires referred to are the light walled tires having a moderately thin resilient tread. Such tires would, of course, be useless on a high-powered petrol car. For very heavy electric trucks special tires composed of a series of wood blocks arranged close to each other around the rim have been tried apparently with satisfying results where the roads are moderately unindented. Another experimental tire for the same purpose was composed of a chain of short lengths of steel wire cable encircling the wheel. The ends of the short pieces of cable were electrically welded, thus preventing any tendency to fray. Several designs of spring wheels that have proved unsuccessful for the high speed for which they were intended originally may prove eventually useful to the electric.

Meeting of the Edison Storage Battery Salesmen.

On Friday, July 11, Mr. Edison called in a number of his storage battery salesmen for a general personal report on trade conditions throughout the country and the formation of plans for next season's business. The remarkable increase in sales since January 1, particularly in the types of battery used by manufacturers of delivery wagons and heavy motor trucks, was enough to give an exceptionally pleasant "atmosphere" to the gathering. The stories of how it was done by the men on the firing line showed that the alkaline, nickel-iron cell was the solution for many battery problems and that Edison sales policy is satisfying the manufacturer and consumer.

In the photograph reproduced herewith, President Thomas A. Edison stands in the middle flanked on the right by R. A. Bachman, vice-president and general manager, and on the left by William G. Bee, manager of sales. Others in the group are E. J. Ross, manager of sales-engineering department; H. L. Davisson, manager of service department; H. G. Thompson, manager of railroad department; C. A. Poyer, manager of house lighting department; H. R. Leisk, assistant manager of sales; John Kelly, manager of New York office; C. B. Frayer, manager of Chicago office; G. W. Holden, Boston and A. O. Heister, Buffalo.



Sales Conference of Edison Storage Battery Company, Orange, N. J.

Despite the recent attacks on the railroads and the present unstable condition of affairs, the orders for train-lighting outfits, and signal service are far above normal. The business in house-lighting sets for country homes where central-station current is not available exceeds already that for any previous season, and is increasing daily. Orders for ignition and lighting batteries on pleasure and commercial gas cars show a much larger percentage of "replacements" sold directly to the user. The electric commercial vehicle has established itself in practically every locality and climate and sufficient data are available in all classes of service to furnish facts and figures on the best equipment for any individual need. The sales engineering force of the Edison Storage Battery Company is using these data to the great advantage of prospective users of modern delivery methods.

Picnic of the Chicago Section, Electric Vehicle Association.

On July 25 the Chicago Section of the Electric Vehicle Association of America and the Chicago Garage Owners' Association held a joint picnic at Cedar Lake, Ind. A special train was provided on the Monon Railroad, leaving Chicago at 10:30 a. m., and consisting of four cars carrying several hundred people. A number of members of the two associations also traveled to the scene of the day's outing in their own automobiles, there being nearly two dozen of these parties.

Electric and gasoline men united in a very pleasurable day of picnicking and atheletic contests, the weather being ideal for this purpose. A baseball game was played between the electrical and gasoline men, the former winning by a score of 12 to 1.

A number of other athletic contests were held for both men and ladies, and about 50 prizes were offered for the winners of these contests.

Books on Electric Vehicles

The Automobile Hand-Book

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Revised and Enlarged 1911 Edition. 16mo, over 650 Pages and over 320 Illustrations. Full Leather Limp, Round Corners, Red Edges. Price $2.00.

The automobile hand book is a work of practical information for the use of owners, operators and automobile mechanics, giving full and concise information on all questions relating to the construction, care and operation of gasoline and electric automobiles, including road troubles, motor troubles, carbureter troubles, ignition troubles, battery troubles, clutch troubles, starting troubles. With numerous tables, useful rules and formulas, wiring diagrams and over 320 illustrations.

Power transmission is thoroughly discussed, and the various systems of transmitting the power from the motor to the driving axle are analyzed and compared.

The perusal of this work for a few minutes when troubles occur, will often not only save time, money, and worry, but give greater confidence in the car, with regard to its going qualities on the road, when properly and intelligently cared for.

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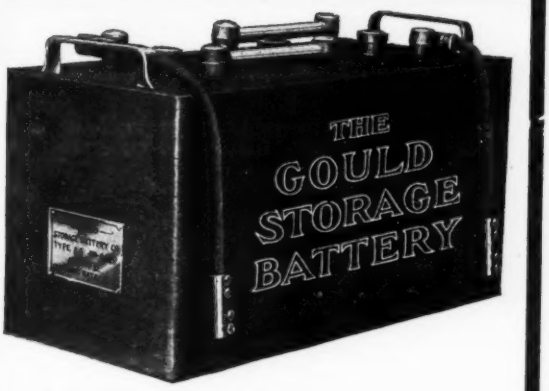

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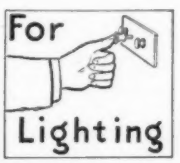

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